

NEW YORK，NOVEMBER 7， 1896.
THE LAKE BIWA－RIOTO CANAL，JAPAN．
by saturo tanabe，assoc．m．inst．c．e．
Lake Biwa，which is the largest lake in Japan，cov－ ering some 500 square miles，is 280 feet above sea level and is 36 miles from the Bay of Osaka，on which is situated a city of the same name，which is the commer－ cial center of Japan．The lake has an outlet called the Yodo River，whose course for the first 13 miles is impeded by cliffs and rapids，when it reaches the town of Fushimi．From this point to Osaka on the sea，a distance of 23 miles，the Yodo is navigable．It will thus be seen that the lake navigation is separated by naturai barriers from the river navigation．About half way between Fushimi，the navigation terminus of the Yodo，and Lake Biwa，is the city of Kioto，which is connected with Fushimi by a canal，but is separated from the lake by the Nagara and Hino－oka ranges of hills．
The objects of the construction of the canal between the lake and the city were
1．To open a line of boat navigation between the Lake and Yodo River through Kioto．
2．The production of water power and the distribu－ tion of power and light in the city by electricity．
3．The irrigation of rice fields in the vicinity．
The work was commenced in 1885 and completed in


THE POWER STATION－CAPACITY，2，400 HORSE POWER．
and ropes at the sides．The tunnel was excavated from both ends and from a $101 / 2$ feet by 9 feet elliptic perma－ nent brick－lined shaft， 150 feet deep，sunk at about one－third the distance from the west or Kioto end The tunnel was begun in March，1886，and completed in February， 1890 ；the headings from the shaft and from the west entrance met in July， 1887.
Some difficulty was experienced in dealing with the water from the shaft and from the lake．There was only one accident on the lake side，where the soil was treacherous．In October，1888，about 15 yards of tim－ bering fell，inclosing 65 miners inside the break．Hap pily，after 47 hours they were rescued．The tunnel was constructed almost entirely by hand labor，on account of the very frequent change of hardness and nature of $t r \geqslant$ rocks，which were full of fissures，and to the cheapness of labor and inability of the miners to manage rock drills．
From the west end of the first tunnel there are 14,511 feet of open canal，sometimes in cutting and at other times on embankment；but mainly skirting the hill side．Water is led off from certain points in this sec tion of canal to irıgate rice fields to the southward． Then comes the range of Hino－oka hills，pierced by two tunnels 411 feet and $\$ 802$ feet long respectively， through clay slate，hornstone and sandstone．Just （Continued on page 345．）

1891，under the direction of Sakuro Tanabe，Assoc．M Inst．C．E．，who was the engineer－in－chief．
Main Canal from Lake Biwa to the City of Kioto． The main canal connects the southwest extremity of Lake Biwa with Kamo River in the city of Kioto． The length of the canal is 36,650 feet，and it has two locks，one inclined plane and three tunnels．The dif－ ference of level in this distance is 140 feet，of which 129 feet are overcome by a lock and an incline，and the re－ maining 11 feet by the canal gradient，which is between one in 2,000 and one in 3,000 ，except in the last stretch in Kioto，where it is almost level．

At the lake end the entrance to the canal is formed on land reclaimed from the lake by debris from the canal and tunnel excavations，and extends about 1,000 feet from the old shore；a breakwater protects this en－ trance．The first stretch of open canal is 28 feet wide， 5 feet deep and 1,800 feet long，and leads to the first and principal tunnel．The level of the lake fluctuates several feet，according as the season is wet or dry，and a regulating lock and sluice gate on this first section are necessary to maintain a constant flow of 300 cubic feet of water per second through the canal．
The first tunnel， 8,040 feet long，passes through the Nagara range of hills and is the longest navigable tunnel in Japan．It has a horseshoe section 16 feet wide and 14 feet high，providing for 6 feet depth of water，and is pierced through a formation of clay slate， hornstone，sandstone and quartz porphyry．It is lined with masonry and brickwork．There is no tow path； the boat being propelled by a chain laid at the bottom


UPPER POOL OF THE CANAL inclined plane，showing drom hodse and entrance to tunnel

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TABLE OF CONTENTS OF SCIENTIFIC AMERICAN SUPPLEMENT No. 1088

## ror the week Ending November 7, 1896

L. CAEMITRTRY-A Stort Method of Deternining Carbon in Steel. P















 XII. PHSSIISS.- Note on the Liquefaction of Hellum.





## international cooperation in the ADVANCEMENT OF SCIENCE

There is a growing appreciation of the fact that the secrets of science, as they are from time to time re vealed, are not, or should not be, considered as the property of the individual, but that they belong to the race at large. This is evident from the increase in the number of societies for the promotion of science, some of which take a name which indicates that this advance ment is the special object of their endeavor. Closely allied to these are the specific technical and engineering societies, at whose periodical meetings the experience and discoveries of the members are recorded, and subsequen:ly published for the benefit of the general public. In addition to the monthly or quarterly meetings of the local branches, there are the great annual gather ings of the technical and scientific societies, in which the chosen representatives of the local societies meet to discuss the progress of the year, and present such new theories and laws as have been proposed or dis covered.
It would be difficult to overestimate the service that has been done to science, whether pure or applied, by these annual conventions. In reading the reports o proceedings, especially the proceedings of the annua conventions, we have often been impressed with the fact that the authors of two different papers upon the same or related subjects will frequently supply each other with the missing link in their arguments. Separated, perhaps, by many thousand miles of distance they have attacked the problem from two differen points of view, and the half truths which each investi gator had discovered, and which promised separately to 'remain an unsolved problem, dovetail together at the convention into a complete demonstration. Co-op eration is the very life of successful scientific research for genius is scarce, while industrious mediocrity is plen tiful. There are, doubtless, multitudes of searchers in the fields of science who are carrying fragments of disjointed truths which, if gathered in one place and pieced together, would make a valuable addition to the ascertained truths of science.
It is true there are the columns of the scientific press which have undoubtedly proved the most effective o all means for the exchange of ideas, the record of dis covery, and the spread of scientific knowledge; but the general congress or convention has the advantage that it is not local in its scope or effect ; that the at tention of the scientific world is centered upon it in the expectation of hearing the very latest and most inportant scientific facts; and that in the various meetings there is an opportunity for the verbal exchange of ideas for question and answer, and for detailed and exhaustive debate. There is an incidental but very rea value, moreover, in the scientific congress in the fact that it brings the members of widely separated districts into contact, and introduces that element of persona sympathy and regard which is one of the most promising features of our modern civilization.
It was a natural step from the National to the Inter national Congress. Within the past few years severa of the latter have been organized, and in nearly every case they have grown steadily and accomplished good work. The arguments for the National are doubly
strong for the International Congress: for the wider strong for the International Congress : for the wide differences of climate, character, opportunities and the annual reunion of their leading scientists a specia value. For, undoubtedly, the system or general drift of scientific research undertaken by any people will be modified by its national temperament. In Germany we might expect that the theoretical tendency would be predominant ; in England and America, the practi cal; and it is in the personal intercourse of the represent atives of these separate schools that we naturally look
for special results, which could never be independently for special results, which could never be independently achieved.
The time is certainly ripe for the establishment of a great international association for the advancement of science. The various national associations have shown by their recent fraternal exchange of courtesies that they are prepared for it and are fully alive to the bene fits which it would confer. They are selecting thei places of meeting near the national border lines, in order that the interchange of visits may be facilitated We learn that the American Association will meet next year at Detroit, and that it will adjourn to Toronto to assist in welcoming the visiting British Association.
This body has responded by inviting the officers of ou gathering to attend as honorary members, and throwing its doors open to all the members and fellows. The same spirit is shown across the water, where the Asso ciation Française pour l'Avancement des Sciences ha chosen Boulogne as its meeting place, and in response to
its suggestion that the British Association should meet at some town on the opposite coast, the latter body has chosen Dover for its gathering in 1899. The mention of the year 1899, the closing year of the century naturally suggests that the opening year of the twen tieth century would be a fitting time for the first meet ing of an international association. It will be the year of the great Parisian Exposition, which will be certain to attract a large number of scientists from
both hemispheres, and the intervening national meet ings will give ample opportunity for founding the association and concluding all necessary arrange ments.

## The New Methydric Sphore.

An Italian inventor named Corzetto, says La Fance Militaire, has constructed an appa:atus which he calls a "methydric sphere," and by means of which he pro fesses to be able to descend to any depth in the sea In his experiment at Spezzia he stored some two thousand cubic feet of compressed air in his apparatus, which he entered with two friends, and which was then lower ed to a depth of some thirty feet. As after the expira tion of nine hours the "sphere" had not yet been seen to reascend to the surface, a message was sent to the admiral in command of the Naval Department, who a once sent a diver to the spot. The "sphere" was foun still resting on the sea bottom, but the diver hear nothing in answer to his knocks. Some barges having been brought to the spot by a tug, the "sphere" wa hauled up with ropes, and as soon as it emerged it door was opened, and the inventor appeared with a livid face and half asphyxiated. His two companions were unconscious, but were quickly resuscitated. They had remained eighteen hours under water. The in ven tor explains that so far all his experiments were suc cessful, but on this occasion when he intended to re turn to the surface the air pressure at his command proved insufficient to expel the water ballast, of abou two tons weight, which had so far kept his appliance submerged, and hence they had to remain where they were until rescued. At any rate, three persons were enabled to remain under water for eighteen hours, and this experiment may not be without significance as re gards the much discussed problem of submarine navi gation.

## Some Beginnings in sclence

The modern plan of instruction offered by the Uni versity of North Carolina more than one hundred years ago was the work of a committee of six. Two of this committee were graduates of Princeton, one a graduate and ex-professor of the University of Pennsylvania two had been students of Harvard, but their education at Cambridge had been interrupted by the Revolution ary War, and the sixth was an eminent lawyer. The names of these men were Samuel McCorkle, David Stone, Alfred Moore, Samuel Ashe, Hugh Williamson, and John Hay. The course planned by this committee in 1792 gave great prominence to the scientific studies, especially those which could be applied to the arts. The report further recommended the purchase of apparatus for experimental philosophy and astronomy in which must be included a set of globes, barometer thermometer, microscope, telescope, quadrant, pris matic glass, electrical machine, and an air pump. The ancient classics were made elective, the degree of Bachelor of Arts being obtainable without the study of either Latin or Greek. In 1800, however, Latin was made a required study, and an election allowed be tween French and Greek; and in 1804 Greek was added to the required studies. It is remarkable that this scheme, adopted in 1792, is almost identical with that adopted by Congress for the colleges to be formed under what is known as the Agricultural and Mechani cal College Land Act of 1862 . But its interest for us to-day lies in the fact that it led to the establishment of the first astronomical observatory in the United States, to the first geological survey by public author ity in America, and to the first equipment for the teaching of electricity.-Appletons' Popular Science Monthly.

The Success of Our Anniversary Number.
The Semi-Centennial Anniversary number of the Scientific American, issued last July, of which we printed 175,000 copies, has been so nearly sold up that the price of single copies by mail has been advanced from 10 cents to 25 cents each. The number was most generously noticed and commended by the press of the country, some three thousand different publications extending to us their congratulations, of which we have been heartily appreciative. The edition con sumed $781 / 2$ tons of paper, and required for its printing the work of eighteen presses, day and night, for two weeks, costing to produce over twenty thousand dol lars; but the resume of our progress in the arts and sciences for half a century which was thus presented in that issue of 116 pages forms something quite unique in the domain of weekly periodicals. The number is already classed as a valuable addition to many libra res, as much of the matter it contains is nowhere els to be found in such convenient and available form Persons unfamiliar with the processes of making and irculating a metropolitan newspaper may be interested in the fact that two hundred and sixty sacks of the largest size, containing the anniversary issue and weigh ing more than eleven tons, were sent through the mail in a single day. As we cannot furnish copies after ou present limited supply is exhausted, it behooves ever one desiring a copy to obtain it without delay. With the order remit 25 cents.

The Removal of the Iron Gates of the Danube.
With the imposing ceremonies which marked the opening of the Lower Danube to navigation on September 27 of this year, one of the most stupendous and difficult engineering wcrks of modern times was put in practical operation, and the "Iron Gate," which have hitherto barred the great natural inland waterway between Western Europe and the East, were at last unlocked. This was not the first time that man had attempted to open a passage; for there are indications that the Roman engineers had studied the problem nigh upon eighteen hundred years ago, and made a partial attempt at its accomplishment. Indications of a road and a canal can be found at the lron Gates, where the natural obstructions are most formidable. Latin inscription bearing date A.D. 101 tells how the emperor "had a road made here by cutting away the rock and putting in supporting beams." Through all the centuries intervening between the Roman ascendency and the nineteenth century nothing of importance was done in the way of improvement, and it was not until the year 1830 that Paul Varsárhely drew up an elaborate plan, upon which all subsequent improvement was based, and succeeded in getting a small portion of it carried out, by the blasting of a canal 104 feet wide and 394 feet long in one of the worst parts of the rapids.
The present successful attempt to open the Danube owes its inception to the Berlin treaty of 1878, which intrusted the work to Hungary, who undertook to bear the expense in consideration of a right to levy tax on the river navigation. The plans of the present work were drawn up by two Hungarian engineers Wallandt and Hozspotzky. The work was let on May 23, 1890, to a German company, the government being represented by the aforementioned engineers, who had charge of construction. The date of completion was December 31, 1895, a remarkably brief time when we bear in mind the uncertainty and magnitude of the work. At the very outset it was found that the peculiar formation of the river bed, the sharp projecting rocks and their intense hardness, necessitated the construction of special plant for its removal. The tools which had done good service at Suez, Panama, and the St. Lawrence River were found to be worthless here, as may be judged from the fact that "in three days in the early operations $\$ 5,950$ worth of black diamond points were ruined; the great percussion drills were shattered, and at low water the boats bearing the drills were caught on the jagged rocks." Nearly two years were consumed in the manufacture of new apparatus, and then the work of blasting the channel began in earnest. In some cases the bed of the river was laid dry for excavation by building solid stone dams and pumping out the water Where this was not possible, the removal of the rock was accomplished by shallow boats, carrying heavy drop chisels, weighing from 8 to 10 tons, which were le fall with sufficient force to break up the rocky bed ready for rennoval. In smilar fashion the holes for dynamite blasting were drilled by a row of tools operated from boats.
The barest recital of the details of the blasting oper ations, which extended over more than sixty miles of the river's length, shows the magnitude of this workby far the greatest of its kind ever undertaken. The figures speak for themselves, and we give them with out comment. A few miles below the island of Moldo va is the first cataract, and here 9,679 cubic yards wer blasted under water to make a canal 197 feet wide and
2,624 feet long-the minimum depth throughout the whole sixty-two miles being ten feet. Nine miles below this is the second canal, one and one-half miles long which necessitated the removal of 86,328 cubic yards. Five and one-half miles further down 61,476 yards were removed to make a canal one and one-fourth miles long. Then the projecting point of Greben Mountain, which made the river too narrow, had to be cut away which meant the removal of 522,300 yards, and just beyond it three stone dams were built because the rive was too wide and the water shallow. Two and one half miles below this a bank of hard rock crosses th river, and here 4,185 yards were blasted out to make a canal 4,265 feet long, and moreover a dam two miles long was built to narrow the channel and increase the depth of water. Six miles below this point the moun tains close in upon the river until the banks are only 328 teet apart, and the water deepens to 164 feet. It is here that the Roman engineers have left an enduring monument in the road along the rocky bank. Seven and one-fourth miles below are the most treacherous cataracts, known as the Iron Gate of the Danube where, after a strip of the bed of the river had been dammed and pumped dry, 497,040 cubic yards of rock were blasted out and a canal 262 feet wide and ten feet deep was built. Two great dams, respectively one and three-quarters and one and a half miles long, wer also constructed.
In the whole distance a grand total of $1,635,000$ cubic yards was excavated, of which 915,600 yards were removed under water. The work was carried out under the superintendence of forty engineers of the company and several others who represented the state Nine thousand workmen were contınuously employed
sans who were engaged at the shops in the manufacture and repair of plant. The boats which were
equipped with foar drills blasted out 84.7 cubic yards in a day of twenty-four hours, and the boats equipped with drop chisels averaged 82 cubic yards per day. The blasts, at times, were very heavy, as much as thirteen tons of dynamite being used in a single charge, the cost of one of the larger explosions having risen as high as $\$ 7,600$. The under-water charges, however, were usually small, with a view to producing debris of a suitable size for removal by scoops and grapnels. The whole work cost $\$ 10,000,000$, and the blasting operations caused the loss of fully two hundred lives.
Previous to the opening of the canal the passage of the Iron Gates was impracticable for an average of one hundred and seventeen out of the two hundred and twenty-five days of navigation in the year for boats drawing more than 5 feet of water; and from the Iron Gates up to Bazios the river was at no time navigable by boats drawing more than 6 feet. The canal will now give Vienna an unobstructed outlet to the sea for boats drawing 10 feet of water

The formal opening was the crowning success of the Hungarian Millennium, and the various nationalities Hungarians, Servians, Roumanians, etc., who were interested in its construction, are justly proud of their great engineering achievement. Fuller details of this great work, with illustrations, will be found in the current issue of the Supplement.

The Relative Performance of the st. Paul and
The Marine Journal, of New York, and the Ship ping World, of London, have recently been engaged in a discussion of the relative performance of the St. Paul of the American, and the Lucania, of the Cunard line The Marine Journal, commenting on the remarkable speed shown by the American boats this year, states that it has "been besieged with communications asking" it " to compute and publish the time the Lucania should allow the St. Paul in their record-breaking trip, worked out by the rule which governs steam yacht racing." The work of computation was intrusted to the well known civil and marine engineer, Charles H. Haswell, author of "Haswell's Mechanic's and Engineer's Pocke Book."
From a calculation based upon Mr. Haswell's formula, $\sqrt[3]{\frac{\overline{G C}}{T^{\frac{2}{8}}}}=V$, where $G$ represents the grate surface; $C$
the air pressure; T, the gross tonnage; and V, the relative speed of the two ships, he finds that the Lucania ha 1.043 times the relative speed of the St. Paul. He then says: "As my formula may not be accepted, I further submit a comparison of their capacities by their tonnage and indicated horse power;" and from this he finds that the Lucania has 1.32 times the ratio of power to tonnage of the St. Paul. Assuming that the speed varies as the cube root of the power, he finds that the relative speeds should be $\frac{\text { Lucania }}{\text { St. Paul }}=\frac{1 \cdot 323}{1 \cdot 206}=1.097 \mathrm{in}$ recent passage the speeds were, Lucania $21 \cdot 37$ miles per hour, and St. Paul $21 \cdot 08$ miles per hour, hence $\frac{21 \cdot 87}{21 \cdot 08}=$ 1.01 , consequently, with 1.097 times the capacity, the peed of the Lucania was only 1.01 times that of the St. Paul, evidencing an advantage in the latter in pro ortions of hull, water lines and application of power Mr . Haswell finally arrives at 10 hours 58 minutes as the allowance, based upon the above calculation, which the Lucania should make to the St. Paul, if they both started from Southampton. If they both maintained the average speeds, $21 \cdot 37$ and 21.08 knots per hour, o the trip in question, the Lucania would be in first by hour 59 minutes, but she would lose the race on time allowance by 8 hours and 59 minutes.
The Shipping World in reply claims that Mr. Has well's formula $V=\sqrt[*]{\frac{G C}{T^{\frac{2}{3}}}}$ is similar to the "displace ment coefficient "formula of the British text books which by a transposition of its members become $=\sqrt[3]{\frac{\bar{K} \bar{P}}{D \frac{2}{3}}}$, when $K$ is a constant, $P=$ power, and $D$ = displacement. The writer claims that Mr. Haswell's ormula takes T (gross tonnage) as proportional to the displacement, "whereas there is little or no relation senger ships, the body above water can be made of very varying forms, and the ratio
tonnage due to deck houses
under-deck tonnage
can be considerably altered. In the St. Paul this ratio is higher than in the Lucania, and to that extent the latter is penalized by his rule." The same write points out that if in the case of the St. Paul the gros onnage, which is 11,629 , be represented by $x+y$, where $=$ gross tonnage below upper deck and $y=$ gros houses, etc., and place an equal weight in the hold," houses, etc., and place an equal wenght in the hold,"
then "the new tonnage is $\mathbf{x}$, and by Mr. Haswell'
rule the speed of the ship is a function of $x$ and not of $x+y$, although the weight and form driven are ex actly the same." He further takes exception to the phrase "speed of vessel is as the cube root of the power of propulsion," for the reason that "when the speed exceeds the limit at which wave-making resistance becomes important in proportion to frictional re sistance the resistance will vary by a higher power of the spee, the resistance will vary by a higher power o the speed." This he claims in the case of "vessels of high speeds would vary as (speed). ${ }^{\prime \prime}$
Without following out the writer's argument any further we give his conclusion, which is that "with equally clean bottoms, draughts not purposely light ened, no detention, and the same weather, the Lucania is just that much better than the St. Paul that she was designed to be."
We think that the expert of the Shipping World has yet to prove his last statement. At the same time it is certain that no reliable basis of comparison could be reached unless a run were made under the same con ditions. If both boats had just come off the dry dock, if their displacements and indicated horse power were accurately known, if they kept sufficiently close to gether to insure their meeting with the same condi tion of tides and weather, and if both were burning the same quality of coal, no doubt a satisfactory time allow ance could be estimated. It is only just to point out that on the trip in question 21.08 miles per hour was the record seagoing speed of the St. Paul, whereas $21 \cdot 37$ wa $0 \cdot 64$ knot below the record seagoing speed of the Lu cania.

There is one point of comparison however in which we think the St. Paul would show a decided superiority provided the oft-quoted daily fuel consumption of the two ships is correct. This would be in a compari son of the two ships on a basis of speed, displacement and coal consumption. According to the daily presswe cannot ascertain how far the figures are official-the Lucania burns 540 tons per day against 310 tons con sumed by the St. Paul. We think that if the two ships were tested on this basis, not even the higher speed of the Lucania and her greater displacement would off set her enormous consumption of fuel. It is just her that the high boiler pressure ( 200 pounds to the squar inch) of the St. Paul and her quadruple expansion engines show to such great advantage over the lower pres ure and smaller range of expansion of the Cunard boats. The subject is of great interest, and if the officials would publish the average indicated horse power, the displacement and the general condition of the two ships in connection with a passage made at full speed, say from the same latitude off the coast of Ireland to Sandy Hook it would be possible to arrive at a very close estimate of their relative performance.
There is no guesswork in the science of ship design s carried out in such notable yards as those of Messrs. Cramp \& Sons and Laird Brothers. The St. Pau and the Lucania were each designed for a special clas of work; and it would probably be found that each ship was approaching very closely to the estimated per ormance, with a balance on the score of economy in favor of the St. Paul.

Sundry Errors in Estimating the Cost.
The estimated cost of the Manchester ship canal was $\$ 28,750,000$. Nearly $\$ 80,000,000$ was spent before the canal was ready for business. The international com mission reported in 1856 that the cost of digging the Suez Canal would certainly not exceed $\$ 40,000,000$. I had cost $\$ 94,500,000$, to say nothing of Egypt's gratui tous building of lighthouses, dredging of the harbors advance of money without interest, and gift of forced labor, the whole amounting to $\$ 20,000,000$ more. Engineers spent a year collecting data for their report on the Congo railroad, which they asserted could be built for $\$ 5,000,000$. They now say that the total cost will be from $\$ 12,000,000$ to $\$ 15,000,000$. The egregious under estimate of cost of the Panama Canal nearly swamped that enterprise before wholesale stealing completed the ruin. The forts on the Meuse River, estimated at $\$ 4,500,000$, cost $\$ 16,000,000$; the Corinth Canal cost $\$ 12,000,000$, instead of the estimated $\$ 6,000,000$; a har bor and a railroad on the island of Reunion cost $\$ 13,500,000$ instead of $\$ 6,800,000$; the Senegal railroad which was to be completed for $\$ 2,600,000$, absorbed $\$ 9,000,000$, and the Langson railroad, in Tonkin, which was to open a conquered province for an expenditur of $\$ 500,000$, bled the French treasury to the tune of $\$ 4,367,790$. Army and Navy Journal.

## The Centennial of Gas Lighting.

The one hundredth anniversary of lighting by gas occurred in July. The first practical trial was made by Murdoch, in Birmingham, England, in July, 1796. It ailed, however, to attract attention, and the next attempt was not made until 1802, when several build ings in Birmingham were illuminated with gas upon the receipt of the news of the peace of Amiens. Gas was introduced in London as late as 1807. Murdoch although not the inventor of illuminating gas, did much to secure its introduction.-Elektrotechnische Rundschau.

## Leut. Wise's Escape.

Lieut. H. D. Wise, stationed at Governor's Island, who has been experimenting with man carrying kites, had a narrow escape on October 21 from being a victim of his own experiments. The kites used were of the well known Hargrave type which we have before described. They are flown three at a time. The half inch rope was attached to a windlass to take up the strain.
Attached to the cable, about a foot below the lowes kite, was a pulley, from which was rigged a boatswain's chair, one end of a line through the pulley block being attached to the chair and the other being left free The purpose of this was to enable the observer to take his seat after the kites had been raised to a point where they would be steady. The pulley rope was 2,500 feet long and capable of sustaining a weight of 900 pounds while the kites were planned to lift a weight of 186.9 pounds. The lieutenant weighs about 130 pounds.
As the kites were raised, the chair was held down on the ground, while the other end of the rope was payed out along with the kite cable, until the kites had attained a height of 200 feet. They were then held taut, and the chair and lanyard were carried to a point immediately beneath them.
The lieutenant seated himself in the chair and was about to make the free end fast, after which the kites were to be permitted to ascend, carrying the observer up with them. Just at that moment there was a slacking of the cable, the pulley fell to the ground, and the kites, tumbling and diving, gradually settled to a point back of Fort Columbus, just south of Castle William It was found on examination that the central spine of the lowest kite had broken and the kite itself was torn in pieces. This had released the cable and pulley. Lieut. Wise has been conducting interesting kite flying experiments for some time.

## A New Port for Russia.

Russia has at last determined to secure access to the Atlantic, and work is actually being begun by the Muscovite government for the construction of a new port and city at a place called Ekatrinograd, situated on the Murman coast of Lapland, between the White Sea and the Norwegian boundary, and at a point which, thanks to the Gulf Stream, is free from ice the whole winter through. A line has likewise been begun to connect by rail the new port with St. Petersburg. The building of this new city and port on the dreary shores of Russian Lapland bids fair to prove one of the great events in Russian history, comparable only to the construction of St. Petersburg, by Peter the Great, at the mouth of the Neva. At the present moment the acces to all Russia's ports in the north could be barred by the powers holding the entrance to the Baltic, while in the same way it is the power commanding the entrance to the Dardanelles upon whom the Czar must depend for access to his ports in the southern portion of his empire. The possession of a great port opening out upon the Atlantic will vastly increase the importance of Russia as one of the great maritime powers of the world.

## CLAY PIPE BINS FOR WINE CELLARS.

The illustration represents a method of storing win in cellars designed to be a great improvem shelving and metal racks. Clay pipe wine bins, such as shown in our illustration, have been known in England for some years past, where the price of such clayware bottle racks is about fifty cents per dozen. The pipes, being separate, are easily transported and stacked in any required position, though in new buildings they can be built into the wall, thus giving a foot more of room in the cellar each way. The crushing resistance o these pipes has been proved to be over sixteen tons per square foot. The advantage claimed for them are simplicity, cheapness, firmness, durability, freedom from corrosion adaptability to spaces of irregular form and odd corners, and a great number of bottles can be stored in a given space. Each bottle having a separate chamber, is protected from currents of air and sudden changes of temperature, and the breakage of one bottle cannot affect another. Being porous, the tubes will absorb water sprinkled over them and the evaporation that ensues will materi ally reduce the temperature; so that when wines and aerated waters are required to be kept cool, the tubes may become a simple and ready form of refrigerator. Weeping bottles can be detected at a glance, each tube being longer than the bottle. Any clay that will make a good drain tile will do equally well for these tubes.

The quantity of oxygen abstracted from the atmo sphere by an acetylene gas flame is much less than that required for the combustion of ordinary lighting gas. For a given illuminating power the acetylene flame raises the temperature less than does that of lighting gas.

AN AOTOMATIC LET-OFF MECHANISM FOR LOOMS.
The illustration represents a mechanism whereby the reduction of tension called for in consequence of the unwinding of the yarn from a loom warp beam, and consequent change in diameter and power of purchase, can be governed automatically and correctly, from a full to an empty beam, with one setting of the mechanism, on the weight and lever principle. The mechanism has no connection with any running or moving part of the loom except the free roller which bears against the warp on the beam, and all the parts


## FORBES LET-OFF MECHANISM FOR LOOMS.

re so arranged that the operator cannot, without using a wrench, put in fewer picks of filling per inch than the nechanism is set and loaded for. The improvement has been patented by Arthur A. Forbes, of St. Hya cinthe, Canada. Our illustration is a rear view at one end of the loom, showing the bearing of the free oller on the yarn on the beam, the roller being journaled in a fork integral with a rack sliding in a frame, and the rack having an aperture in which may be placed a pin to limit its movement when it is moved to et the mechanism. The rack may also, by means of engaging lugs and a screw in one side of the frame, be moved to bring it into or out of engagement with a pinion on a vertical shaft at whose lower end is a bevel wheel engaging a similar wheel on a horizontal shaft. On the latter shaft is a scroll or pulley having a spiral roove, which receives a wire passing over pulleys on the loom leg to a weight attached to its other end. The other end of the shaft is connected by bevels to a shaf extending longitudinally of the loom, and on the latter shaft is a pinion engaging a loose pinion on a parallel shaft above. On this upper shaft are pulleys, not shown in the illustration, to each of which is connected one end of a friction band encircling the head of the beam, there being a friction band for each head, and on the there being a friction band for each head, and on the
shaft are also rigidly secured parallel arms or levers on


HONEYCOMB WINE BINS OF VITRIFIED CLAY PIPE.
which runs a car propelled by a chain from the loose pinion, and the car may be locked so that the operator cannot interfere with the weight. The arrangement is such that, upon a proper adjustment, the predeter mined position of the car always corresponds to the proper position of the free roller relative to the center or axis of the bean, and the leverage exerted by the weighted car always has a predetermined relation to the distance of the roller from the center of the beam.

When the roller has come in contact with the yarn, it radually follows the reduction in thickness which en ues as the yarn is reeled off the beam, and simultane ously the car travels on the levers to gradually reduce the pressure of the friction bands upon the beam heads. The mechanism is designed to suit any unusual make of loom and comply with the requirements for any class of goods.

## ".Chronophotography."

"Chronophotography," or that branch of instanta neous photography which faithfully records movement phases, claims more attention than it has hitherto received in connection with its application to medical subjects. M. Marey, the eminent French physicist and physiologist, was among the first to elaborate the chronophotographic method and to extend it to fields of interest in medicine. Everybody is familiar with the zoetrope, an instrument which, when set revolving portrays some moving figure-e. g., a horse in full gallop. Formerly the pictures-each of which represented a different stage of movement-were drawn by hand, but now by the introduction of photography the zoetropic representation of motion has been brought to a beautiful degree of perfection. The application of chronophotography to the study of the vital processes of the movements concerned is extremely interesting Thus a very accurate observation of the movement of the blood in capillary vessels may be observed, and among the facts brought to light is that the circulatory current, though appearing very swift to the eye, is in reality a very sluggish stream. Very curious move ments also may be observed in zoospores. "The move ments of the zoospores may be followed throughout by observing in a series of photographs the successive position they occupy in the mother cell. But no adequate description could be given to those who have never watched the phenomenon of the activity which reigns within the cell, and only ceases when all the zoospores have succeeded in effecting their escape." Chronophotography has also afforded fresh informa tion of a most important and interesting kind as to the nature of physiological movement, and particularly has this been so in the case of the analysis of cardiac movements by this means. Thus experiments have led to the knowledge of the order and sequence of the auricular and ventricular movements from the changes in pressure which they express. It has been shown that the diastole of the ventricles coincides exactly with the ystole of the auricles. Obviously the study of such minutely accurate observations is of the utmost impor tance to medical science, and we are glad to find that this extremely delicate method of recording movemen is likely to become of more general interest and of more extended application now that an excellent and well translated little work on the subject* has been published, which we strongly recommend to the notice of our readers.

The Destruction of the Colosseum.
The Colosseum was made to stand forever. If we gaze at it from the east side, where it appears still in tact, we are forced to exclude the possibility of a spon taneous collapse of such a substantial structure. Ye the repeated concussions of the earth in the fifth cen tury may have caused a crack or rent like the one which cuts the Pantheon on the side of the Via della Palombella. If such an accident occurred in the Pantheon in a solid wall fifteen feet thick, built by such an experienced architect as Hadrian, it is even more likely to have happened in the Colos seum, the outer belt of it being of stone with out cement, and pierced by three rows of arcades and one row of windows. The equilibrium once destroyed, the results are obvi ous, especially if we remember how quickly arborescent plants and trees take root and prosper in the dry soll of an abandoned building. The stones on the edges of the crack must have been lifted or wrenched from their sockets by th3 roots wedging themselves into the joints and acting as levers. Readers famliar with the vignettes of the Colosseum of the sixteenth and seven teenth centuries will remember how exactly they represent this process of disintegration of the edges, stone by stone. When Pius VII determined to build the great buttress to support the edge of the outer belt on the side of the Via di S. Giovanni in Laterano, he was obliged to employ convicts serving for life, promising them a reduction in th term of imprisonment if they succeeded in propping it up. The danger was such that the for est of timber used in the scaffolding could not be re moved while the masons were progressing with thei work, but had to be left embedded in the thickness of the supporting walls.-Prof. Lanciani in the Atlantic.

* Movement. By E. J. Marey, Professorat the College of France, Directo of the Physiological Station. Translated by Eric Pritchard, M.A., M.B.
B.Ch. Oxon. With 200 Illusuration. London: William Hememann. $189 \%$

THE LAKE BIWA-KIOTO CANAL, JAPAN.
(Continued from first page.)
below tunnel No. 3, at about 51/4 miles from the intake, the canal divides into two branches, of which the branch canal is described later.
The main canal designed for navigation descends 118 feet in 1,815 feet to the level of the city. To overcome this descent of about 1 in 15 , a summit inclined plane is used; the boats with cargo being transported up and down on cradles on wheels, hauled by a steel wire rope which passes round a drum worked by a wire rope which passes round a drum worked by a
Sprague electric motor of 50 horse power, 440 volts, Sprague electric motor of 50 horse power, 440 volts,
the electricity being sent from the water power
105 feet. Of the 300 cubic feet of
building 110 fation, which is a bric
nected by three 36 inch pipes with the high level canal on the top of the incline. The intake is just below tunnel No. 4, and is protected with a gridiron to prevent floating objects from entering the pipes. Of three pipe lines, at present only two are laid, of which one line is cast iron imported pipe, 36 inches in diameter and 1,164 feet long, and another line is wrought iron riveted pipe, also 36 inches in diameter and 1,486 feet in length, including the piping inside the power station. The effective head of water at the power station, which is a building 110 feet by 128 feet, is abou

PLAN SHOWING
tween them. Also 2,000 volt Thomson-Houston and Brush dynamos are used for distributing power and lights to longer distances. Electric motors, which are supplied from the station, are situated within a circle of from one mile to two miles radius from the station. These motors work spinning, weaving, watch, clock and soda water factories, rollirg mills, rice mills, etc. The motor for running the drums of the inclined plane already described also receives a supply of electricity $\underset{\text { Bromed Canal }}{\stackrel{-}{2}}$
he oanal incline \&s
iwater power station.



plan and profile of lake biwa-kioto canal and incline.
station. Four lines of 75 pound steel flat bottomed |water per second, which the canal carries from the lake|from the station. The motor and drum house is situated rails are laid on wooden sleepers with 8 feet 3 to the top of the incline, about 60 cubic feet per second at the top pool of the inclined plane, three-eighths o inches gage on the formation line, which rises with flow into the branch canal, and the remaining 240 cubic a slope of 1 in 18 from the upper pool to a summit feet per second flow through the said pipes. Two 36
$11 / 2$ feet above water level, and then descends with a slope of 1 in 15 to the lower pool. Two cradles, each with eight wheels, are worked with 4 inch steel wire rope, which hauls up the cradles and boats from the water in one pool and puts them into the other pool. The rope is endless and is worked by a drum 12 feet in diameter; while one cradle rises by one line of railway, the other cradle descends at the same time, and it takes about twelve minutes, stoppage included, to transfer the boat from one level to another, a distance of 1,815 feet. From the foot of this plane there is a stretch of canal 60 feet wide and 5 feet deep, extending for $11 / 4$ miles, and joining with the Kamo, and thence to the shallow water canal Takase, with a lock of 11 feet lift between them.
water is 3 feet per sec water

The width of the boat is about 7 feet, the draught 2 to 3 feet, and the length ranges up to 45 feet. It carries cargo of 10 to 15 tons in the canal, as well as over the inclined plane. Paddle or screw propulsion is prohibited, and the velocity of towing should in no case exceed 5 feet per second. Tolls for boats which carry merchandise are at the rate of 30 cents per 10 ton boat per voyage from the lake to the city, and the boats pass the locks and inclined plane free. Passenger boats pay a tax of about $\$ 9$ per boat per year; in addition to which the boatmen pay 3 cents for the passage of each lock every time and 12 cents for the inclined plane.

Water Power Station and Distribution of Power to a Distance by Electricity.The water power station is situated at the foot of the canal incline and is con-


INTERIOR OF DRUM HOUSE, 8HOWING SPRAGUE ELECTRIC MOTOR-LAKE BIWA RIOTO CANAL.
mile from the station. The Kioto Electric Light Com pany also receives a supply of electricity from the sta tion and feeds the city with 3,000 sixteen candle power incandescent lamps and 100 arc lights. About 1,000 horse power is now being sent out in the form of elricity from the station and the demands are increasing rapidly. The following are the rates at which the station sup plies electricity. Mill owners must buy motors, switch plies electricity. Mill owners must buy motors, switch-
board, etc., but do not pay for wiring conductors from the central station to their factories. The following ar the rate for power :

| For 1 | 1 horse power at $\$ 60.00$ per horse power per annum. |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
| 10 | " | ${ }_{38.50}$ | " | " |
| 30 | * | 27.50 | " |  |
| 50 | $\because$ | 25.00 | $\ddot{\square}$ | " |
| " Above 100 | " | 22.50 | " | " |

These are the daily rates for 12 hours' use ; the increase is 30 per cent fo 18 hours' use and 50 per cent for 24 meters with bigher rates.
Branch Canal for Irriga tion and Water Power. -The branch canal at the head of the inclined plane already described leads northwest through a tunnel 8 feet in diameter and winds along the sides of hill. It crosses the valle hill. It crosses the valle of the Imperial Tomb by an aqueduct of 14 arches and passing spurs of an other hill by two short tunnels and crossing the Ta kano and Kamo Rivers with two siphons of about 300 feet length each, it ter minates at Kogawa, the north end of the city of Kioto This canal Kioto. This canal only carries about one-fifth o the water supply admitted from the lake, and the fal in some places is as great as 1 in 100 , the section being reduced ; the least fall is 1 in 2,500 . The length of the canal is 27,690 feet. It main object is the irriga tion of rice fields in the
environs of the city; about half of the supply reaches Kogawa, where its power is used for weaving and spinning rills. The water thus used serves after ward to irrigate rice fields toward the west of the city The rate for water when used as power is $\$ 10.25$ pe horse power per year. For irrigation it is $\$ 95$ pe cubic foot per second per year from the high leve canal and $\$ 12$ from the low level canal.

The Conway Expedition to Spitzbergen.
The London Times recently published an account of a conversation which Mr. Trevor-Battye, on his return from his recent journey in Spitzbergen, had with a representative of Reuter's Agency. To this report we are indebted for the following particulars. As will be remembered, Mr. Trevor-Battye was a member of Sir Martin Conway's expedition, and, as arranged, left Sir Martin Conway, Dr. Gregory, and Mr. Garwood, in company with Mr. Conway, the artist, and Pedersen, of Tromsö, near Advent Bay, for the purpose of exploring some of the northern parts of the island. The first ob ject was to explore Dickson Bay, the most northerly bay in Ice Fjord, the northern part of which had neve been mapped. In this work the explorers seem to have met with very considerable difficulties from flowing ice and the remains of the old winter pack. However, they landed at a place on the western shore, and spent the night. In the morning, the ice having opened a little, Mr. Trevor-Battye and Pedersen crossed to the other side, being anxious to find out something of the charac ter of the country which separates Ice Fjord from the sea lying to the north. At the north end they found the tide was out, and great stretches of mud of a very tenacious character were to be seen. In the distance running northwest appeared what seemed to be a val ley; but, at a nearer view, it proved not to be a valley at all, but an enormous glacier, the front of which was masked by an immense and intricate moraine. The glacier, in striking contrast to the majority of glaciers, is a retreating one, and is slowly dying back. On reach ing it, the explorers found it a mile and a half wide ing it, the explorers found it a mile and a half wide and many miles in length. Pedersen, being anxiou about his boat, returned to her at this stage, and
Mr. Trevor-Battye went on alone, and presently climbed Mr . Trevor-Battye went on alone, and presently climbed
the snout of a rounded glacier, by which he hoped to the snout of a rounded glacier, by which he hoped to
be able to effect a crossing. It was, however, badly be able to effect a crossing. It was, however, badly
crevassed, the crevasses becoming wider and more for midable at every step. In his own words: "I had no expected to find ice, and so was not prepared, not even having a stick or a gun with me. I wanted to push on however, although aware of the fact that the undertak ing was rash, and one which, under the circumstances, no Alpine guide would have attempted. I went some distance further, but, sinking to my knees on a snow bridge half spanning a crevasse, I had to reach th other side by flinging myself forward. Later, while standing at the edge of another crevasse, a large body of solid ice, which was jammed between its walls, fel with a roar as I was going to walk across it. A little ahead I could see the col, from which I knew I should have sight of the sea; but I found it impossible to proceed without proper ice tools, for the crevasses betwee me and that point were masked by deep snow, and I felt any further attempts to be quite unjustifiable. I had now reached a height of 1,800 feet-not of mountain, but a gradual rise of ice river from the sea. The return journey I found more difficult, as the crevasses had to be met down hill, and a slip upon their rounded edges would have been fatal. Finally, I rejoined Pedersen after a walk of twenty-two hours. We then returned to Cape Wörn, and explored the western bay of Ice Fjord. According to Nordenskiold's map, on which our Admiralty chart is based, a large island occupies the center of this bay; but after cruising about for two days, we found, to our surprise, that it no longer existed as an island. The glacier-which, by the way, we named 'Splendid Glacier'-had encroached to such an extent, and so rapidly, that it had entirely, filled up one neck of the bay, and had also covered two-thirds of the island. In a few years' time the head of the bay will be completely obliterated."-Nature

## Heat Resisting qualities of Wired Glas

A recent issue of the Journal of the Franklin Institute gives particulars of some tests recently made to determine the fire resisting qualities of wired glass, i. e., glass containing in its texture woven wire netting, as manufactured by the Mississippi Glass Company, of St. Louis. The information is given in a report to the Philadelphia Fire Underwriters' Association, and the results of the trials s'rowed that glass of this kind is capable of withstanding a high temperature, very much higher than ordinary glass, without melting or losing its continuity, even when suddenly drenched in a heated state in cold water.
The conclusions drawn from the tests, and given in the report, are as follows :

1. Wired glass can safely be used in skylights, and in such situations will stand a severe fire, and not give way when water is thrown on it. A wooden framing for skylight, covered with tin, all seams lock jointed and concealed nailed, is superior in fire resisting quality to iron framing.
2. Wired glass in wooden sash, covered with tin, all seams lock jointed and concealed nailed, can safely be used for windows toward an external exposure
3. Wired glass can safely be used in fire doors to elevator shafts and stairway towers, where it is neces sary to light said shafts.
4. In office buildings, hotels, etc., where it is undesirable to have elevator shafts entirely inclosed and dark, wired glass permanently built into a brick or terra cotta shaft, or arranged in a wood metal-covered rame, can safely be used
5. Wired glass plates, securely fastened in standard fire shutters, can safely be used toward an externa exposure. In this case, the fact that a possible fire in a building, all windows of which are protected by fire hutters, can much more readily be detected from the outside through the wired glass, is of importance.
The capability of the wired glass to withstand a temperature beyond the melting point of glass appears to be attributable to the fact that the network of wire in the glass acts as a good conductor of heat, and hereby prevents the accumulation of sufficient heat o melt the glass; and although it may thereby be softened and rendered pliable, the network of wire prevents the glass from giving way by reason of its own weight when softened by the heat.
AN IMPROVEMENT IN STRINGED INSTRUMENTS.
The illustration represents an instrument adapted to be played with a double pick, and provided with a raised portion forming a stop to limit the movement of the pick. The invention has been patented by Francisco Barrientos, of San Juan Bautista, Tabasco, Mexico, and communications relative thereto may also be addressed to Faustino Avila, V, of the same place. Fig. 1 shows the application of the improvement and Fig. 2 is a
cross section on the line of the raised stop. The double pick consists of a handle with downwardly projecting points or teeth, and when the performer strikes the strings with the pick simultaneously, both above and below the bridge, different notes are produced, one of which is two octaves higher than the other. The performer may also, instead of striking the strings simultaneously above
and below the bridge, play theoctaves in succession, pro ducing a somewhat different effect, the instrument then sounding as if the performer were playing on two instru ments of different pitch.

BARRIENTOS' MUSIC INSTRUMENT.

The Utility of Inventions
It is no doubt true that when a new invention is inroduced which revolutionizes some particular art or branch of business, it at first decreases the number of persons employed in that particular line; but that is cheapening of the product, a greatly increased demand or it, because of this cheapening, and then necessarily an increased demand for laborers in that line, and almost universally at increased wages. The statistics show this to be true beyond the possibility of a question. The records of the Labor Bureau of the United States show that, from 1860 to 1880 , the most prolific period of inventions, and the most intensified in all directions of their introduction, the population increased 59.51 per cent, while in the same period the number of persons employed in all occupations-manuacturing, agriculture, domestic service and everything -increased 109.87 per cent, and in the decade from 1870 o 1880 the population increased 30.08 per cent, while the number of persons employed increased 30 per cent. As shown by the investigation of a committee of the United States Senate, wages have increased 61 per cent in the United States since 1860. And, as we all know, during the same period the cost to the people of nearly all manufactured articles has been decreased in as great

## M. Noissan in America.

M. Henri Moissan, of the Institute of France and of the Académie des Sciences, who came to this country for the Sesqui-Centennial of Princeton University, lectured at the College of Physicians and Surgeons, New York City, on October 27. His subject was the uses of the electric furnace and was most interesting. He made an artificial diamond, to the great delight of the
audience. audience.

The Russian Geographical Society has been asked by he governor-general of Turkestan to send some men of science to Shignan and Roshan next summer, for the purpose of making a thorough exploration of those egions.
A monument has been erected at Boulogne in honor f L'Hoste, the French aeronaut, who first crossed from France to England in a balloon. He crossed three times successfully, but was drowned in the fourth ttempt.
That well known geographer, Prof. Egli, died recenty at Zurich in his seventy-third year. He edited the Nomina Geographica," a work which gives the pronunciation and definition of no fewer than 42,000 geographical names in all parts of the globe.
The mortality from the plague in China is 95 per cent of all cases. According to a letter to the French Academy of Medicine, Dr. Yersin has discovered a new serum remedy for the plague, which reverses the figures, leading to about 95 per cent of recoveries.
An untamed swallow, which had its nest in a farm near Chetwynd, in Shropshire, was caught and taken in a cage to London, where it was released. It returned to its nest in eighty minutes, having accomplished a distance of 145 miles at the rate of nearly two miles a minute.
According to Engineering, some recent researches by Captain Abney show that the light of the starry sky is to that of the full moon about as $1: 44,000$. The latter is usually considered to be about as $1: 600,000$ to that of the sun at noon, so that we receive over $13,000,000$ million times as much light as from the stars, taking both hemispheres into consideration.
M. Moissan states in the Annales de Chimie et de Physique that the most stable compounds known to science disappear in the electric furnace. The only exceptions are the perfectly crystallized borides, silicides, and carbides discovered by him. These, he hinks probable, are original constituents of the globe and must still exist in some of the stars.
An effort is to be made to induce the Prince of Wales o place himself at the head of the movement for celebrating at Bristol, in June next year, the four hundredth anniversary of the discovery of North America by John and Sebastian Cabot, who sailed from Bristol. It is hoped that the foundation stone of the memorial will be laid by the Prince of Wales simultaneously with one laid in Canada.
A Hamburg young man has just had his sanity proved by the Roentgen rays. He declared ten years ago that he had a bullet in his head which he had fired into it in trying to commit suicide. He complained of the pain and, as he attacked his keepers, and the doctors could find no trace of a wound, was locked up as a dangerous lunatic. The Roentgen rays have now shown the exact place of the bullet.
The total number attending the meeting of the British Association was 3,181, of whom 713 were old mem bers. The sum of $£ 1,355$ was divided in grants. The recommendation that a national physical laboratory should be established was adopted, and so was one urging upon the government the necessity of establishing a bureau of ethnology for Great Britain, as such an institution would be of immense value, not only to science, but to the government itself.
The American trans-continental arc, as surveyed by he United States Coast and Geodetic Survey, has been completed. It lies along the thirty-ninth parallel, north latitude, and extends from a point near Cape May, on the Atlantic, to a point above San Francisco, on the Pacific coast. According to the measurements made the distance, reduced to sea level, is $2,625 \cdot 8$ miles; and from these measurements the radius of the thirtyninth parallel is yet to be determined. While this survey has cost about $\$ 1,000,000$ in the aggregate, the ongest base line heretofore run is that across India, about 1,000 miles long. As compared with the radius of the thirty-ninth parallel, as given by Bessel of Germany, this arc as measured is 111 feet in error; and according to the figures of Andrew Clarke, of Glasgow University, it is $981 / 2$ feet in error. But the bureau claims that these variations are due to errors in previously established standards.
M. Francois Felix Tisserand, a well known astronomer and member of the Institute, died from apoplexy October 20, in Paris, at the age of fifty-one years. He entered the Normal School in the Section of Sciences in 1863, and later became assistant astronomer at the observatory. At the organization of the astronomical service, in 1873, he was appointed director of the observatory at Toulouse and professor of astronomy of the Faculty of Sciences of that city. He was subsequently appointed professor of rational mechanics of the Faculty of Sciences of Paris, and was transferred to the chair of mathematical astronomy in 1883 . He was appointed director of the Paris Observatory in 1892, in place of Admiral Mouchez, deceased. In 1874 he was aesistant to M. Janssen on the voyage to Japan to observe the transit of Venus. In 1878 he was appointed a member of the Bureau of Longitude. He was author of a number of works pertaining to his profession.

## Sorrespondence

To the Editor of the Scientific American :
In the detailed description of Prof. Olszewski's attempt to liquefy helium, given on page 17299 of the Supplement of September 36, a noticeable fact is that he arrived within $9^{\circ} \mathrm{C}$. of the so-called absolute zero point of temperature
The accepted value of this point, $-273^{\circ} \mathrm{C}$., is based on the observed fact that the volume of a gas increases or decreases the ${ }_{5} \frac{1}{4} \frac{1}{5}$ part for each degree Centigrade of increase or decrease of temperature. Then the further assumption was made that this change of volume is re gular for the "permanent" gases over the whole range of temperature. Hence, at $-273^{\circ} \mathrm{C}$. the molecules of the gas should be in contact.
But, judging by analogy from the expansion of so lids and liquids, we should also expect the change of volume of gases to vary according to a parabolic law, having their greatest change at and near the point of liquefaction. This view is strongly supported by the fact that, if we calculate the mechanical equivalent of heat by using the only known expansion of air between $0^{\circ}$ and $100^{\circ} \mathrm{C}$., instead of the assumed double volume at $273^{\circ} \mathrm{C}$., we will obtain a value, viz., $776 \cdot 4$ foot pounds or 42,642 gramme-centimeters, which is nearly that of Griffiths and which is now extensively used.
Some years ago, while studying molecular physics, I discovered such a parabolic relation. By using the ac cepted terms it may be thus stated. It can be shown that the square of the mean free path varies directly with the absolute temperature in the gaseous condition. But the mean free path of the molecule is equiva lent to the diameter of the mean free space occupied by the molecules. For convenience, we can call this space the molecular volume, because the total aggregation of these minute volumes makes the given gaseous volume then the free path becomes the cube root of the molecular volume. By substitution in the above, we then get the new relation. The two-thirds power of the molecular volume varies directly as the absolute tem perature : hence, their aggregation, thegaseou
will also vary in the same way $-V^{\frac{1}{3}}: V^{\frac{1}{2}}:: T: T$.
When we make the calculation with the foregoing data of Regnault, from $0^{\circ}$ to $100^{\circ} \mathrm{C}$., we get as the absolute temperature of $0^{\circ}$ C., the freezing point, $1^{\mathbf{1}}$ $1 \cdot 3665^{\frac{2}{3}}:: \mathrm{T}: \mathrm{T}+100^{\circ} \because \mathrm{T}$ for air is $432 \cdot 113^{\circ}$; for hydrogen it is $431 \cdot 921^{\circ}$.
In my paper on helium, published in the Supple ment of June 22, 1895, page 16948, which was written on the announcement of its discovery, I made the mis take of giving helium the second place on the curve in stead of the third. By making it the third element, and judging by the fact that at $-264^{\circ} \mathrm{C}$. helium shows no signs of liquefying, then its deduced liquefying point in my paper, viz., $-332^{\circ} \mathrm{C}$., which is $68^{\circ} \mathrm{C}$. lower than the above, does not seem improbable.
Los Angeles, Cal.
W. H. Masser, U.S.N.

## systematic Inspection of Material.*

It would seem that it ought to be completely superfluous to tell a man that it was advisable for him to know what he was buying, or that it would pay him to ascertain whether or not he was getting full value for his money. It will require but a very superficial observation, however, to show that the contrary is the case, and that it will be necessary not only to tell him, but in many cases the most convincing arguments will be ineffectual.
The facility with which all classes of nostrums are foisted on the community, and the difficulty of obtaining reliable material, go to show that very few realize the necessity of knowing when the material they buy is what it should be.
No more valuable move has been made, of recent years, by our railroads, than a recognition of the fact that it was necessary to know accurately the character of the material they were using, both in track and rolling stock; so that at the present time all first-class roads either have a testing bureau, as a special department of their own organization, or employ one of the numerous testing bureaus.
The fact that the leading engineers have, for years, required careful and systematic tests of material on all important work, that on the Continent testing bureaus have been established under governmental supervision, and the number of independent testing bureaus in this country, proves the practical necessity for the systematic examination and testing of the materials of construction.
This demand comes from two quarters: 1st. The necessity of protecting human beings from injury or death. 2d. The necessity, especially at the presen time, for practicing the utmost economy.

It is scarcely necessary to discuss, or to advance arguments. to prove the necessity for taking every precauWhile this has been treated as an economic problem. more than once, that phase need scarcely be discussed

[^0]here, for its value as a factor in the design of any
structure will depend entirely upon the moral condistructure will depend entirely upon the moral condition of those in charge of the work.
The value of systematic testing, from an economic standpoint, however, is open to fuller discussion, and brings up more interesting questions.
In conversation with an engineer the other day on this subject, he told me that he was satisfied that he had been compelled, recently, to use from 15 to 20 per cent more material in a building than was necessary on account of the impossibility of having the material carefully tested, and this in face of the fact that especially good prices had been paid for it. The saving on a few such buildings would have equipped a testing laboratory.
In a recent investigation of the strength of cements, a sample of cement, which sold for $\$ 5$ per barrel, when mixed with one-half sand, showed a greater tensile rength than did a sample of another cement selling for $\$ 3.50$ per barrel, when used neat; and yet enormous
quantities of this cheap cement are used.
The author has again and again seen lubricants sold to private consumers, under some high-sounding name, at from 50 to 75 cents a gallon, which were nothing but plain petroleum products, worth, probably, at the most, 20 cents per gallon. One cannot blame an oil rather hard on the man who foots the bills. A considerable portion of the lubricants sold to small consumers are not worth one-half what is paid for them. In fact, it may be taken as a rule that in_every branch of trade more or less chicanery and fraud are deliber of trade more or less chicanery and fraud are deliber-
ately practiced, the only safeguard against which is the careful examination of the material.
But it will be argued that one can deal with honest manufacturers only. While it is unquestionably good policy to have no dealings whatever with dishonest parties, yet this does not remedy the matter.
A manufacturer or dealer may be as honest as possi ble, but that does not prevent his employes from mak ing mistakes, or from willfully shipping defective mate rial to cover their own errors. We might, perhaps, locate dishonest dealers, but it would be impossible to ocate the ignorant, careless, or dishonest employe.
The athount of material with defects, which it is inconceivable that any sane person could fail to see, which is shipped by the most reputable concerns, proves that the honesty of the head of a concern does not insure the honesty of his subordinates, although it may go a long way toward it.
We have, therefore, to avoid not only the dishonesty of the manufacturers, but also the dishonesty and carelessness and ignorance of their subordinates.
In a steel mill a forging may be piped; if carefully plugged, the chances are that nothing will be heard of it until the failure of the forging reveals the hidden flaw; too late, however, to trace it back and place the esponsibility where it belongs.
It has been held, and by the majority believed, that it is necessary to have inspected and tested the materi-
als used on only the more important structures, such as bridges, office buildings, etc., where there is danger to life or limb of the occupants. While it is undeniably true that such material should be inspected, it is also true that, as a rule, greater economies can be effected by inspecting other kinds of materials, where the results of the failure are not so dangerous to human life and consequently not so disastrous to the reputation of the manufacturer.
The very fact that in most instances the other kinds of material are purchased without any examination at all, gives an invitation to all kinds of fraudulent practices. There is an extensive trade in certain materials, which are used for adulteration alone.
In an investigation, made by the writer, of different brands of white lead, only two out of six samples were found to be worthy of the name of white lead; three being utterly worthless.
Upon one occasion, a shipment of lard oil received by the writer was found to contain a large portion of par affine oil; it was returned, and a second shipment replacing it was also returned for the same cause. At
last a shipment of oil was received which was satisfac tory. When asked why they shipped such defective material, the reply was that they did not expect it to be so rigidly inspected.
That the rigid examination of materials, which are now received without inspection, is desirable, can scarcely be denied, but how far it should be carried,
and to what extent it would be economical, is another and a more difficult question to solve. It is evident that it would be advisable, if practical, to have every thing tested and inspected: but throwing aside this utopian idea, we can readily see that the systematic
inspection of material can be extended far beyond it present limited sphere, with very beneficial results.
As an illustration of what can be done by such inspec tion, we can find no better example than the results obtained from the inspection of fertilizers. At one time fertilizers were sold entirely on the makers' guar antee or statement; now, in nearly all States some sys. izers sold in the State are subject to inspection and
analysis, and in some States any citizen can send a sample of fertilizer to the State chemist, have it ana lyzed, and an estimate of its value, per ton, placed upon it.
The result of this system of fertilizer control has been not only a marked improvement in the value of the fertilizer actually sold, but, what is of far more import ance, the introduction of a condition of affairs which enders the sale of worthless fertilizers practically imossible.
Similar benefits can unquestionably be obtained from an extension of this system to other materials, such as iron, steel, cast iron, oils, paints, and soaps. At pre sent it is very difficult to get a paint which is worth anything, or a good lubricating oil at a reasonable price, and many of the soaps sold throughout the country are so injurious to clothes as to be worse than useless. Is this not, after all, a matter for governmental control? It may be claimed that this is too much like paternalism, but it is unquestionably the duty of the overnment to detect and punish fraud whereve ound, and there is considerable room here for the exercise of this function. Have not all classes as much right for protection against fraud as the agricultural, if that class would not be the principal beneficiaries of government inspection ?-Digest of Physical Tests.

## The Serpents of Java.

A correspondent of the Illustrated Family Newspaper relate:
The Imho sugar estated in Java comprises over 12 000 acres, about one-third of which is in cane. This is ne of the most densely wooded parts of Java, and the bush is like a wall, impervious even to many wild ani mals, but snakes flourish, and there are no less than ten varieties that are deadly poisonous. Eight of the coolies employed on this estate have died inside of four months from snake bites. The chain viper is most dreaded, as it will not get out of one's way, and when trodden on by the barefooted natives strikes fatally Twelve miles away is the ruined city of Choru, a wilderness of temples built of stone, cut in designs as fine as lacework. On the north side of these buildings re long arched passages, and here wild animals resort to get out of the intolerable heat. Leading from these avenues are hundreds of small chambers having no windows. In these lurk more snakes than can be ound anywhere else in the island.
It is not surprising that the eastern nations look upon Englishmen as lunatics, they do so many foolhardy things from no apparent motives save to risk their lives. Two years ago an English naval lieutenant was here visiting a neighboring planter, and his peculiar raze was making a collection of Javan reptiles. His only attendant was an English sailor lad about sixteen, and these two, against all warning, went roaming around the forests without a guide. In Choru, the ruined city, the lieutenant found a rich harvest, and killed a magnificent black jaguar, but an adventure with a snake ended his sport. One day he and the boy were under one of the long archways of the big temple, and, looking through the doorway of one of the dark chambers, saw something yellow in the far corner. Without a moment's thought he entered and gave the mass a punch with his cane. A tremendous hiss that airly shook the walls was followed by an assault swift as the leap of a tiger, and the man found himself seized
by a huge Dari snake, the most aggressive and dangerby a huge Dari snake, the most aggressive and danger-
ous of our constrictors. His left shoulder was crushed in the brute's teeth, and quick as a flash a coil was around his body, and he felt the steel-like compression. But the grit of the boy saved his master's life. He had a heavy, sharp wood knife, and he struck the reptile two heavy blows just back of the head, the most vulnerable part of its body, because the thinnest. Its backbone was divided. The coil relaxed, but the powerful tail lashed out, breaking the boy's leg. It was two hours before they were found and brought up in a cart. The lieutenant's left shoulder was crushed beyond surgery, and the arm was useless. Both master and boy recovered after a spell of fever. I saw the snake, a hideous object, black and yellow, and fifteen reet long. Such a brute would crush a horse.
Gunning one day near the Wasli River in the interior of the island, I watched a number of wild hogs coming to the water to drink. Suddenly the head of a snake rose above the grass and a hog squealed. A python had seized a full grown one, easily three feet high at the shoulder, and thrown two coils around the body. Under the tremendous pressure the hog seemed to lengthen, and when the snake uncoiled I saw only a strip of meat, nothing distinguishable but the head. I shot the snake. It was twelve feet long and over seven
inches through, and yet its coils had crushed the bones inches through, and yet its coils had crushed the bones
of its prey like chips. There is no doubt that hidden way in vast swamos of the interior are many anacondas of enormous size. Parties have been made up to hunt them, but the malarious climate drives them back. In the museum at Batavia is the skin of a serpent that must have been fifty feet long when living. Such a brute would kill a, man as easily as it would a rabbit.

## AN EXPLOSIVE NUT (HURA CREPITANS).

 In the vegetable kingdom we find several varieties of fruit that are explosible by various natural processes, and they belong to several famlies. In the wise economy of nature the object of this bursting is to disseminate the seeds. Probably the most peculiar explosive fruit is that of the sand box tree (Hura crepitans) of the family of Euphorbiaceæ, which opens its fruit with a loud report, scattering the pieces in all directions. We present an engraving of this nut, an example of which was sent to the Scientific American to see if a remedy for the explosive feature could be devised, so that it could be used as an ornament. Of course nothing can be done to prevent this explosion, except, possibly, to plate it heavily with some metal, as copper.The tree is found in tropical America, the particular example under con sideration coming from the Amazon River valley The tree grows to be from seventy to one hundred feet high. The bark is smooth and yields a milky sap when tapped. The twigs are sometimes spiny and the leaves are of ter six inches broad. The trees are often cultivated for ornament, from the West Indies to Brazil If left to ripen on the tree, the nut explodes with a sharp report, when each of its curious compartments, numbering sometimes as many as sixteen, flies asunder, so that its seed, which somewhat resembles a pumpkin, seed, drops out. Our engraving shows the condition of these ruptured cells. The nut has a dense woody fiber. The nuts stand exporting, and occasionally do not explode for several months. The pieces are thrown several feet when the explosion takes place. If the nut is kept in alcohol or water, it can be preserved for years. In the Scientific American Supplement, No. 1051, an explosive fruit of the genus Justicia is described. When they are thrown into water they explode with a loud report, so that what tends to pre plode with a loud report, so that what tends to pre-
serve Hura crepitans proves fatal to Justicia. In

## THE PLANTIN-MORETUS MUSEOM.

There is a solidity and an old time burgher flavor about Antwerp which impresses the visitor, notwithstanding the fact that it is now one of the busiest ports on the Continent of Europe. Many of the fronts of the on the Continent of Europe. Many of the fronts of the
houses are commonplace, and none mora so than the
unassuming exterior of one of them in the Place du

an explosive nut (HURA CREPITANS).
many superb examples of his art. He was stabbed one night, so that he was incapacitated from carrying on his trade. In 1555 he printed, or possibly only published, his first book; the next year four more, and so on, until his ability as printer and publisher was fully recognized. All went well until he printed an alleged heretical prayer book. This caused him to retire to Paris for a few months. The matter was adjusted so that he was enabled to return, and with the help of borrowed capital he soon turned out an astonishing number of books. In four number of books. In four ears published ove two hundred works, which would be considered phe nomenal even in our modern publishing world. His business enlarged so he was obliged to take in a number of additional houses, so that, notwithstanding the fact that his successor altered and rebuilt some of he houses, the building emain very much as he eft ther much as he left them. He obtained Philip II, of Spain, and was assisted by that monarch to print the Royal Vendredi, but, once within the portal, all is changed, Polyglot Bible in four languages, a work in eight vol and we stand face to face with one of the most exquisite monuments which the revival of learning has left to us. We stand in the courtyard of the Plantin-Moretus Museum-a museum devoted to one art, that of printing. In the buildings grouped around this courtyard, printing was carried on not only as a trade, but as art, for a period of three hundred and twelve years by a whole dynasty of editor-printers, the Plantin-More tus. Happy has been their lot to escape the fate which overtook those more celebrated printers, Gutenberg, Aldus, Elzevir, who have left nothing behind but their books. To-day the museum is a. complete exposition of the methods of. work carried on from the time when the printer had begun to be a power in the world until the new order of things came in with he advent of power printing.
Before examining this printers' paradise in detail, let umes. This was at that time the largest and most ex pensive work which had ever issued from the press. Plantin lost heavily on this book, but was recouped by being given a monopoly for the printing of mass books and prayer books for the Spanish dominions. books and prayer books for the Spanish dominions. He suffered many reverses, as when his establishment
was sacked in 1576 . He died in 1589, leaving a considwas sacked in 1576. He died in 1589 , leaving a consid-
erable fortune. All his family had been impressed into the service, and his son-in-law, John Moerentorf whose name was Latinized into Moretus, succeeded him. The policy of the house was now somewhat altered, for while Plantin had set authors at work and really caused the works to be written, his successors adopted the more modern course of printing the works which were brought to them. The property was re stricted by a curious clause in Plantin's will, that the stricted by curious clause in Plantin's win, that the operty should be transmitted to the child who should


COURTYARD OF THE PLANTIN-MORETUS MUSEUM, ANTWERP.
either case the explosion may probably be referred to $\mid$ its founder, Christopher Plantin. He was born at according to the ancient traditions of the house. For the tension on the hard fiber.

Beer is being bottled now in Germany in siphons that hold fifteen, twenty-five, and forty glasses. When drawn the beer is said to be as fresh as if drawn from the wood.

Tours . in 1514, studied in Paris, and finally went to Antwerp in 1550; here, for the next thirty-nine years, he struggled nobly with many reverses and laid the oundations of one of the most celebrated printing houses in the world. He first established himself as a worker in leather and as a bookbinder, producing ing office practically ceased to exist and the print-
single workman was employed, and in 1867 the great $/$ sides rise the printing offices and houses of the old bur- on a side street, where the books were disposed of. range of buildings was closed. In 1876 the city of Ant- gher family, the façades of which are in many cases Here to-day may be seen piles of old and dusty books werp bought this unique gem from Edward Moretus decorated with busts and with the pair of compasses which await the customer, while the scales stand ready for $1,200,000$ francs, and after careful restoration it was
opened as a museum, and, having outlived its useful-
of the family, while one side is entirely covered with
a calendar of 1595 . Plantin's daughters used to sell ness, it has descended to the "most worthy" of old $\quad$ the branches of an old vine. The curious old seven- books in this little shop. To the left of the arcade Christopher Plantin. teenth century pump, the carved staircase and bench were the rooms devoted to the correctors of the press.
The courtyard is about as pleasant and withal are all objects of interest. Directly behind the arcade Here, as in all the buildings, the restoration is carebookish a spot as could be imagined. Around its four shown in our engraving were the bookstores, fronting fully, almost lovingly done, not a single incongruous note


TYPE FOUNDRY OF THE PLANTIN-MORETUS MUSEUM.

disturbs the whole; the pictures on the walls, everything, is in perfect keeping, and looks as though the eminent scholars who acted as proofreaders and editors had just left it, and in one case, indeed, if our memory serves us aright, a pair of spectacles lies on the half corrected proof sheets. The press room is certainly not as Plantin left it, for there are now only seven or eight presses, two of them being those used by Plantin. From these old ramshackle affairs came, however, the magnificent specimens of typography which are the magnificent specimens of typography which are to-day eagerly sought by bibliophiles. Looking at al-
most any of the examples of the clear, even impression of the Plantin press, it will be seen that, indeed, the printer was superior to his method.
The flooring, made of narrow bricks, is much worn. On the walls are some sheets printed by the not overnuscular hand of royalty. Leopold I. of Austria, and Maria Louise, and others have struck off sheets. The pressroom is probably the oldest room in the whole range of buildings. In his earlier days Plantin caused his types to be cast for him, but finally he introduced a foundry of his own. Our engraving shows the casting room. Here, behind a wire screen, may be seen the mould and punches, while the furnaces and crucibles are ready for use. When we compare the printing done with the heavy full-faced type of these old printers with that produced by modern type, perhaps machine set, we must admit that, while something has been gained, much has been lost. Still, to-day, thanks largely to the late William Morris, who by the productions of his Kelmscott Press has educated people, there is now a demand for type which combines all the advantages of the new and the old.
The rooms all over the house are filled with old furniture, tapestries, carvings, books, paintings and engravings. Some of the rooms are very richly decorated, as Plantin's private office and the room assigned to the celebrated scholar Justus Lipsius. Of course the museum is not as Plantin left it. His successors were opulent and were men of taste. So it is little wonder that in time the collection became very valuable, even possessing several examples from the brush of Rubens, who also did designing for the establishment. After it was purchased by the city the collection was most admirably arranged. While it is true that the thirty-odd apartments may be visited in a morning, still it is the kind of a collection which grows on one, and repeated visits may be made without exhausting its interest.

Intensification with Bromo-iodide of Copper.
The gelatine negative must first be thoroughly freed from hypo, otherwise it is impossible to intensify it satisfactorily. The bromo-iodide solution is prepared as follows :

## Sulphat Water

When dissolved, and in a thin stream, with constant stirring, the following mixture :


A slight precipitate will form : this must be allowed to settle, the clear liquid only being used.
The negative (if previously dry) must be well soaked in water to soften the film, and then be immersed in the above solution in daylight, when it will bleach to a yellow color. After washing it can be blackened with an old hydroquinone developer.
The following formula will give a red color :


Various tones of sepia, dark brown, and iron black tones can be obtained by varying the proportions of hydroquinone and sulphite of soda. The development should be done in bright daylight, or even sunlight, in order to secure the best effects. The method will be found useful for modifying the tone of lantern slides.The Amateur Photographer.

## Questionable Application of Science

In a technical contemporary we find the following pas sage, which, whether its assertions are true or false, claims the attention of analysts: "Scientific training seems very often to be diverted into curious channels. A large calico printer recently informed us that the chemical knowledge of the German drug and dyestuff manufacturers seemed to be devoted entirely to the art of defeating tests rather than to the manufacture of drugs to pass genuine muster. It was the Germans who introduced that dangerous adulterant in Portland cement-gypsum, to wit-entirely with a view of cir cumventing the American tests for cement. It matters not to the Germans that their cement is rendered dan gerous, and that better results can be attained by salt
means at very trifling cost. They have found an adult erant to serve a merely temporary purpose, and that is erant to serve a merely temporary purpose, and that is
all they care to do. The Japanese seem to be followall they care to do. The Japanese seem to be follow-
ing on similar lines. It would be amusing were it not ing on similar lines. It would
so pitiable."-Chemical News.

Recemíl Archæological News.
M. Perce recently informed the Paris Society of Civil Engineers that Alexander the Great employed the first submarine boat at the siege of Tyre in the year 332 B. C. Italian engineers have found that the two Roman vessels discovered in Lake Nemi can be raised without too great difficulty, and the government has taken measures to have this done soon.
Russia's archæological congress is presided over by woman, Countess Praskowja Sergejewna Uwarow widow of Count Alexis Uwarow, who founded the society in 1869, and herself a distinguished archæologist. She makes a model president, listening to all the papers and summing them up intelligently.
Probably the earliest known example of piece moulding among European bronze foundries is a mould for a spear head, which was found at Thonon, France, among the relics of the lake dwellers. It is described by Mr. George Simonds as having been composed of two slabs of stone, on each of which a spear head was cut out to a proper depth. The two stones, being placed face to a proper and bound together, would form a very simple face and bound together, would form a very simple without injury to the mould itself.
Sir Joseph Archer Crowe, the distinguished English journalist, war correspondent, diplomatist and art critic, died on September 7. His title to fame rests not so much on his work as diplomatist as on his writings. In connection with Signor G. B. Cavalcaselle he wrote a monumental series of works on the art of the Italian Renaissance. These books include the two histories of painting in Italy, the Raphael and the Titian. The works are specially noted for the use which is made of documentary evidence, so that, while much of their criticism is out of date, they will never be entirely super eded
In the ancient city of Nuremberg, during the year 1859, there were found under the pavement of one of the streets a large number of burnt clay dolls, figures of knights on horseback, and even dolls' toys, which give us a very clear idea of how the children of the fourteenth century amused themselves. Naturally, the boys and girls of the middle ages were not so fasticious as those of this age of luxury, says the Pottery Gazette. Colored eggs, painted birds carved out of wood, little windmills with movable sails, and baked clay shapes of all kinds of animals were re garded as possessions to be highly prized
M. Berthelot recently read a paper before the French Academy of Sciences on "The Copper Mines of Sinai, Worked by the Ancient Egyptians," says the Engineer These mines are near the coast of the Gulf of Suez, and are undoubtedly the most ancient known to history, having been worked at least 5,000 years before the Christian era. They were abandoned about 3,000 years ago, on account of the small amount of copper present in the ores. The reduction appears to have been carried out by methods not differing essentially from those in
use at the present day, wood being used as the reuse at the present day, wood being used
ducing agent, together with fusible silicates.

During 1897-98 it is proposed that the archæological survey operations in Madras should embrace the most important monuments in the Tinnevelly district, many of which are of great interest. The number of places which it would be possible to visit is contingent to great extent on the amount of work, to be ascertained after inspection. Among the chief remains of interest arethoseatSattur, Sankaranayanakovil, Virasakamani Kalugumalai, Kuttalam, Tenkasi, Korkai, Maraman galam, Srivaikuntam and the Valavanad Hill, con sisting of temples, ancient city sites, rock cut caves, monolithic temples, Jain sculptures and inscriptions cairns, Siva and Vishnu temples, sepulchral and other remains. The most extensive work will be in the great Siva Temple in Tinnevelly town. Government has approved of the programme.-Indian Engineering. The theory and construction of the vases which wer formerly employed in Greek and Italian theaters to aid the acoustic effects of the building remain as puzzles, says the Architect and Contract Reporter. All that is knownabout them is what Vitruvius reports, which is as follows: "Of the brazen vases, which are used on account of the magnitude of theaters, they are so formed that upon being struck they sound in them selves the notes diatessaron, diapente and so in orde to disdiapason ; after which they are disposed, accord ing to the laws of music, in cells, formed within the seats of the theater in such a manner as not to touch the wall, and have a vacancy all round them to the top of the cell. They are situated inversely, and on the side which is turned toward the scene; they ar supported by wedges, not less than half a foot high also opposite the cells, in the beds of the lower seats apertures are left two feet long and half a foot high Rome has not any theater thus constructed, but the provinces of Italy and many provinces of Greece can show them. Lucius Mummius, who destroyed the theater of Corinth, brought to Rome the vases of brass which were used at the plays acted in his triumph likewise many ingenious architects, who construc theaters in small towns, to save expense, make use of justed according to rule, answer the purpose."

The African Cyclist has just been started at Johannesburg, Africa, where cycling is said to be in a very fourishing state.
The French Touring Club now has 42,000 mem bers. Many Americans belong to it, although they may not have any immediate intention of traveling abroad.
Paris is going ahead in the matter of catering for cyclists. In the beautiful Bois de Boulogne there is now a special avenue, over a mile in length, which is exclusively reserved for cyclists.
It is said that the patrons of a large tourist agency, whose business is world embracing, will in future be mounted on bicycles when the tourists prefer that mode of locomotion in the excursions in foreign cities.
An Eastern concern has recently brought out a rack for bicycles, which may be used either in baggage cars or upon the dash of street cars. It folds flat against the wall or dash when not in use, to economize space, occu pying in that position only four inches in depth. The parts of the holders which come in contact with the wheel arecovered with rubber to insure against scratch ing.
According to a recently published Trades Directory there are in England no fewer than 5,270 cycle agents in Scotland 512, and in Ireland 512; and the total num ber of makers, both small and great, is set down as 2,595 . In addition to these figures it is of even greater interest to learn that there are 46 newspapers and peri odicals directly connected with cycling in the United Kingdom.
The capacities of the leading steel tube mills in this country, for bicycle work, is far beyond the consump tion. It is estimated that $24,000,000$ feet of steel tube have been used this year, but there are seven mills and one of them alone can turn out $18,000,000$ feet : the com bined output of the other six mills amounts to 64,000 , 000 feet, so the bicycle makers have to treble their pro duct before they can fill the mills with orders.
The Czar of Russia has been traveling considerably of late and paying his respects to the rulers and the peo ples of Western Europe. When traveling the Czar re ceives a courier every day from St. Petersburg, bearing dispatches, and he sends one back in return. Some of the work of these men on a pinch is done on bicycles, for the Czar rides himself and takes a great interest in th bicycle. He took careful note of the good roads o England, and was unstinted in his praise of them.
An enterprising bicycle dealer of Berlin recently applied to the authorities for permission to erect 250 stands all over the city and suburbs where bicycles and tricycles can be hired. The wheels hired can be return ed to any of the stands and the amount to be paid is regulated by coupon checks. The hire of a machine is only 10 pfennige ( $21 / 2$ cents) for the first 15 minutes and pfennige for every additional 10 miles. A mark is deposited when the wheel is taken out. The wheel is specially marked and painted.
A young man has put his bicycle to profitable use in Australia. He has practically established a posta route between Coolgardie in the center of the gold fields and Dundas, the nearest town. The distance be ween the two places is 280 miles, but he carries letter and telegrams backward and forward in a small lette box strapped on the back of his machine, for one shil ling and five shillings apiece, respectively, making the rip once a week. A water bottle, revolver and sharp knife are the chief items of his outfit-essentials in that arid and bushranger-infested country. - Posta Record.
An ingenious device has been employed in the Wes to keep cattle off of cycle paths without interfering with the free use of the path by wheelmen. At each road crossing a gate is placed, which is usually kep locked, but may be opened on the occasion of parades or on holidays. At the side of the gate is a "cattle guard" constructed in this manner: A pit about three feet by four and two feet deep is dug. At the top of the pit an oak frame is set, and across it, on a level with the top, is placed a row of two inch gas pipes, two nches apart. Across these pipes a bicycle can be rid den with ease, almost without jolting the rider, while cows, horses, sheep, etc., find it impossible to cross th barrier.

Hydrostatic Exploration of the Abdomen.
M. Marc Sée has communicated to the Académie de Médécine, says the Lancet, a method of exploring the abdomen which he claims to be new and which is cer tainly ingenious. Anyone can see for himself, says M See, that when completely submerged in a bath his anterior abdominal parietes become quite flaccid, even if he should be moderately corpulent. The various or gans and structures beneath can then be recognized and delimited by simple palpation with greater facility and accuracy than is afforded by any other system of exploration. The relaxation is explicable on ordinar hydrostatic principles. The abdominal walls, loaded as they are with fatty matter, tend to float upward toward the surface of the water, thus to a certain extent counteracting the elastic and contractile forces which tend to keep them in close contact with the viscera.

## assadaga propaganda.

## BY WHLIAM BENJAMIN

The fascination wlich the general public finds in clever tricks and illusions is not hard to account for Some of the brightest minds in the world are seeking to improve this form of amusement, and at no time in the world's history have so many really mystifying novelties been before the public as at present.
The rivalry between Herrmann and Kellar, the lead ing magicians and illusionists in this country, has caused each to exert himself to secure the very latest novelties in that line.
One of the most mysterious among Kellar's repertory of successful illusions is "Cassadaga Propaganda," an explanation of which is herewith presented.
I will first outline the effect as produced teen by sixty inches in size is placed upon the backs of two chairs, and on it is erected a small beautifully finished cabinet consisting of four pieces, of which net consisting of four pieces, of which
the sides are hinged to the back, and which, with the front, are seen resting which, with the front, are seen resting
on a chair at the side of the stage. When on a chair at the side of the stage. When
erected, the cabinet is forty-two inches high, thirty-six inches wide, and fourteen inches deep.

Tambourines and bells are placed in the cabinet and the doors closed, when the instruments instantly play and are thrown out at the top of the cabinet. The cabinet is now opened and found to be empty Any slate placed in cabinet has a message written thereon. In fact, all manifesta tions usually exhibited in the large cabinets are produced, and yet this cabine is apparently not large enough to contain a person. We say apparently not large enough; for, in reality, the whole secret consists in a small person, or an in telligent child of ten or twelve years of age, being suspended by invisible wires behind the back of the cabinet, where there is a sma shelf on which the concealed assistant is sitting Turkish tashion. This folded cabinet is hung on two fine wires which lead up to the flies and over rollers or pulleys to the counterweights. When proper wire is used on brightly illuminated stage they are absolutely invisible
After showing the chairs and placing glass upon them, the performer picks up the folded part of the cabine and places it on the glass, the counterweights overcom ing the extra weight of the concealed assistant, opens out the sides, places the front containing the doors in position, fastening same by hooks to the sides.
The inside of the cabinet and panels of doors are lined with puckered gold silk. There is a concealed opening in the silk at the back of the cabinet, for the assistant to pass his arm through, in order to handle whatever is placed within it
Everything being in readiness, the tambourine and bell are placed in the cabinet and doors closed. Th assistant now passes his hand and arm through the. opening in the back and shakes the tambourine, rings the bell, and throws both out over the top of the cabinet, when the doors are opened and cabinet is shown to be empty. Clean slate placed in the cabinet are removed with nessages written on them; in fact, the manifestations that can be produced in the cabinet are limited only by the intelli gence of the concealed assistant.
One of the cuts shows the cabinet with open doors as seen by the audience. The second cut is an end view looking from the side of stage, showing the assistant on a shelf at the rear of the cabinet, and the wires leading up and over to the counter weights.

Fear Among Soldier
Every one has heard the story told of Marshal Ney, to the effect that he wa observed just prior to a desperate charge apostrophizing his trembling legs and telling them that they would shake a great deal more if they only knew where he was going to take them. This physical sensibility to danger and mental resolution to face it constitute, in the opinion of H. W. Wilson, who writes on "The Human Animal in Battle" (the United Service), the highest type of courage. The Literary Digest, from which we copy, quotes what he has to say
"Fear is greatest where the imagination is strongest It is an emotion which seriously affects both body and mind. On the physical side it checks the flow of saliva and brings that peculiar thirst of the battle field; it causes organic derangement and a certain degree of muscular relaxation, increases the tension of the voice, and is accompanied by a desperate effort to avoid the danger. On the mental side it paralyzes the intelligence and leads to the blind desire for flight, though sometimes it goes even further, and deprives the vic-
tim of all power of movement. If flight takes place, $i$ is the flight of panic, a reflex and often involuntary act. Only strength of will can overcome this tendency to run. As a matter of fact, flight is rarely the best road out of danger ; in battle it is the worst. To go forward and die is certainly better than to go backward and die for, in the first place, the enemy, who is experiencing precisely the same emotions, will lose courage and shoot ess steadily, thereby diminishing the risk of the assai ant. Nothing is more contagious than panic, a singl man with ashen face rushing to the rear will draw others after him and shake the confidence of all who see him. Hence the problem is how to implant courage and avoid panic
"Courage is simply control of the nerves, and is largely due to the habit of confronting danger. Gen


CAbsADAGA PROPAGANDA-THE CABINET OPEN FOR INSPECTION.
they stood or sat about camp, at the slightest noise How, then, is courage to be taught in peace? A Russian general once proposed to 'salt' his soldiery by loading one rifle in ten with ball cartridges during maneuvers. This ghastly preparative was too revolting to civilized minds, and it has never been carried out but if adopted, it would make the army trained under such circumstances invincible, and so in the end tend to shorten war and save life. It would accustom the soldier to the sights and scenes of the battle field, and vercome his dread of the unknown. It would enabl him to control his nerves in the tumult of the actua encounter. Such a pursuit as climbing has the same moral effect. Endurance, mutual trust, self-control may be learned on the high Alps, or, for the matter o that, in a Wastdale, where a slip on the face of th mountain means destruction. The volle of stones down some precipitous gulley is not less deadly than the hail of shells and bullets on the battle field. And, in a less degree, hunting, and the manlier forms of athletics, give the same result Sports involving risk to life are thus of supreme value from the national point of view, and this should be remembered when the ignorant and degenerate assai them.'

Establishments in Russia The past few months have seen the developmenf of two important enterprise in Russia, which are to be conducted largely with American capital, and will be under American management. The first of these contemplates the establish ment at Nijni Novgorod of a plant for the manufacture of locomotives of the American type, by a combination of capitalists entitled the Russian-American Manufacturing Company. The enterprise is indirectly the outcome of the Chicago Exposition of 1893, when certain visiting eral Sherman thus defines it: 'All men naturally ${ }^{\text {Russian engineers were so favorably impressed with }}$ shrink from pain and danger, and only incur their the display of American locomotives in the Transrisk from some other higher motive or from habit so that I would define true courage to be a per ect sensibility of the measure of danger and a menta willingness to incur it, rather than that insensibility to danger of which I have heard far more than I have seen. The most courageous men are generally uncon scious of possessing the quality; therefore, when on professes it too openly by words or bearing, there is reason to mistrust it. I would further illustrate my meaning by describing a man of true courage to be one who possesses all his faculties and senses perfectly when serious danger is actually, present.' Pride, habit, duty hese are the forces which enable men to control them selves. All can be fostered and implanted by training. Sheridan reckoned that, of able bodied men, about one ourth have not the requisite capacity for courage, and are, therefore, useless for battle. Such weak heart


THE SPIRIT MANIFESTATIONS.
must be weeded out. 'No matter how brave a veteran may be,' says Private Wilkeson, of Grant's army, 'he relies on the men on either side of him to stand there till they fall.

He must know that his comrades are as stanch fighters as he.'
"Even in the bravest and most fully tried men fear is subdued and not wholly eliminated. Skobeloff said of himself, 'I confess that I am at heart a coward.' He despaired of General Gourko because the latter would duck to avoid bullets and shells. In the Northrn army, at the close of the civil war, General Horace Porter tell us that there were only two men known to him who never bowed the head to iron and lead. Of these, one was General Grant. So purely a matter of habit, a reflex action, had such ducking become, that
portation Building that they placed large order with the Baldwin Locomotive Works, and also sug gested the establishing of works in Russia. The present enterprise is the result of these negotia tions, and the construction of the plant and works is now in progress. Nijni Novgorod already pos sesses a large Russian engineering plant known as the Sormovo Iron and Steel Works, which gives em ployment to 5,000 hands in the construction of engines, bile to 5 , be built in connection with the existing plant. It will have a yearly output of 200 locomotives and give employment to 10,000 men
Another important venture is being made in Southern Russia, where an American company, known as the Nicopal-Mariopal Mining and Metallurgical Company, with a paid up capital of $\$ 2,275,000$, has been formed to secure control of the rich manganese mined at Nicopal. According to the Philadelphia Record, these mines are under American management, and it is proposed to ship the ore to Mariopal, on the shores of the Sea of Azov, where an extensive steel plant is to be built and placed under the management of a gentleman who was formerly in the employ of the Illinois Steel Company. The new mining company has already given evidence of its activity by securing the contract for the delivery of ten thousand tons or one hundred and forty-four miles of pipe, for use in the oil well districts of the Caucasus ; and to insure that the contract should be filled in time it is stated that the company purchased in this country an entire pipe building plant for shipment to the new works in Russia. The acquisition of these mines is a matter of no little importance to the steel industry of the world at large, for the latest statistics show that the district in which these mines are situated "supplies fully one-half of the world's requirements of manganese ore." Russia has long been famous for its manganese deposits, and the exports have increased at a rapid rate during the past decade. Thus the total exports, which in 1885 amounted to $79,499,002$ pounds, increased in 1890 to $295,929,390$ pounds, and in 1895 to $364,858,007$ pounds. Of this amount, $137,035,600$ pounds went to Great Britain, $113,498,400$ pounds to Holland, $95,603,600$ pounds to the United States, $13,032,100$ pounds to Germany, and $4,295,900$ pounds to Belgium.
The progress of these two important American industries on foreign soil will be watched with great interest. Russia is developing a remarkable activity in those fields of enterprise which make heavy demands upon the iron and steel industries, and it is reasonable to expect that the two ventures above mentioned will
be followed by others of a like nature be followed by others of a like nature.

## RECENTLY PATENTED INVENTIONS Engineering.

A Perforated Boiler Dóor.-Jean Hartmann, Mulhouse, Germany. This invention, which has been likewise patented in many foreign countries, is for a door designeà to facilitate the sweeping away, without any diminution of the intensity of the fre, of
any soot or dust deposited by the any soot or dust deposited by the guses on the walls or
tubes of boilers, or in other tubular or partitioned heating apparatus. The door is made with a number of perforations corresponding to the situation of the several tubes or spaces between the tubes, and pivoted plates are made to cover one or more of the perforations, which
may be conveniently uncovered, ons by one, as demay be conveniently uncovered, ons by one, as de-
sired, for the insertion of a brush or other cleaning in-


Rallway Appliances.
Car Draw Frame.- John Shaw, Woodburn, Oregon. This is an improvement on a former invention of the same inventor, devised to fa-
cilitate the removal of any desired part of the frame for cilitate the removal of any desired part of the frame for
repairs or other purposes. The draught mechanism comrepairs or other purposes. The draught mechanism com-
prises upper and lower tubes or rods engaging at their outer ende the drawheads, each abuttiug with its rear face on fixed shoulders on the thbes or rods, and being held in place by collars and nuts. Ties connect the tubes
or rods at or near the middle, and between the ties is a or rods at or near the middale, and between the ties is a
block of wood with recessed corners forming seats for the block of wood with recessed corners forming seats for the
tubes or rods, the ties being held in place by clamping tubes or rods, the ties being held in place by clamping
bolto, there being also spring casings which form seats for the tubes or rode.

## Electrical.

Telephone Transmitter. - Horace c. Alexander, Bonham, Texas. This improvement is
designed to facilitate the transmission of the greatest volume of sound without causing rattling or grating, and to that end a spring-supported flaring conical cell is provided with a flange covered with soft material which rests on the carbon button carried by the diaphragm, the carbon cell being filled with granulated carbon resting in contact with the carbon button. When sounds are uttered a jarring of the granulated carbon, thus varying the conductivity of the cell, and producing the differences current necessary for the transmission of speech.
Safety Attachment for Locks.Adrien J. Moulart, Paris, France. Simple means for
jiving a signal every time the lock is opened are provided by this inventor. Two conducting half sleeves are arranged out of contact with each other in the lock; and a split keyhole sleeve surrounds them, there being an insulating sleeve between the keghole eleeve and the halr leeves, wine in circul whin theris an lectically operated signal device, such as an electric bell. When a
key or picklock is inserted in the keyhole, the circuit is closed by the bridging of the space between the half sleeves, and the sigual is sounded. It is also impossible to break the lock without sounding the signal
Burglar Alarm Circuit Closer. Charles H. Dowden, Newark, N. J. In devices adapted or use in connection with windows, wo cose the electric
circuit and send an alarm when either sash is moved, this nveution provides for two side plates between which is reccessed insulating block, spring contact blocks being pivoted in apertures in the side plates, and completing a
circuit between the plates when either contact block is circuit between the plates when either contact block is
presed inwardly. The device its easily in a recess in one of the parting strips that separates the sash, and intantly closes the normally open circuit when either sash is mooved, thus sounding an alarm.

## Mining, Etc.

Primer for Blasting Fuses.James H. Hart, Meaderville, Mont. This invention pro. vides an igniter especially adapted for use in wet mines,
consisting of a sleve capable of embracing the end of the fuse, a cap or primer in one end of the sleeve being capable of lying adjacent to the end of the fuse, while a head strenethens the sieeve on its outer side around that portion which receives the cap. The device may be made esparately from the euuee and apphied when desirided,
or each fuse may be supplied with one of the iemiting devices. The explosion of the cap will not cause the upture of the sleeve, and the head perm heing fired
Roasting Furvace.-James L. Wells, Leadville, Col. To utilize most effectively the available heat from the burning ore, and insure a complete roast-
ing at a comparatively low cost, this inventor har devised a furnace which has a shaft with zigzag flues through which falls the ore to be wasted, a hot air chamber connected with the lower ends of the flues passing hot air upward through the downwardly moving ore. A hearth receives the ore, and an air chamber is divided from the
hearth by perforated bed plate, while a fume chamber is separated from the hearth by a perforated top plate.

## Mechantcal.

Bit Gage.-Edmund Van Cau wenberg, New York City. This is a device for regulating the depth of bore of a bit, and is secured directly to the bit
instead of to the brace. thus obviating the necessity of emoving the chuck, and saving time. The gage is quicky and easily adjustable, and consists of an exteriorly bit, and be clamped thereon by segmental clamping blocks, while an interiorly threaded gage sleeve engages the screw thread of the first sleeve. After adjusting the gaze sleeve a set nut is turned down to prevent ite back-
wand rotation.
Pump Valve.-George Parker. Whitng, Ind. This invention consists principally of a valve disk with a hub fitted to slide on a fixed valve stem, a casing extending from the head of the stem and one end of the tub being in the open end of the casing, there bethe head and the hub. The valve disk 18 held to its the head and the hub. The valve disk is held com-
place by the force of the spring, and the latter is com-
pletely incloed, so that in case of breakage its pieces
will be confined and not liable to injure the working
parts of the machine. The space over the valve stem and under the head also forms an air chamber or cushion pocket, giving easy
closing of the valve.
Shuttle Threader.-Rémi Brodeur Fall River, Mass. This device comprises a blow tube, a suction tube and.means for forcing air through the blow suction tut tho pame time causing a suction through the to thread the shattle. The device is designed to super sede the custom of threading shattles by drawing in the the end of a bobbin within a shuttle may be quickly drawn through the eye of the shuttle, whether it be extended through the right or left hand side of the shuttle.

## Agricultural.

Planter.-- Jesse W. Stancil, Farmer ville, La. This is a planter which may be interchangebly employed to plant cotton or pea seed, or other simiorted frame has sliding ways at the rear, over which is a hopper, a board sliding in the guideways forming the bottom of the hopper, the board being provided with rop slides, and there being in the hopper a seed-distributing device operated from the driving wheels. The planter may be attached to any form of plow, and the furrow, after being opened, is rendered more or less drag after having been deposited in the furrow.
Spraying Apparatus.-James C. Olard, Tacoma, Washington. This is a machine to be drawn by horses for effectively spraying fruit trees, vines, liquid tank, at each side of which are discharge pipes liquid tank is an air tank to be filled with air under pressure by an air pump which is operated by the trave ployed for spraying the liquid from its reservoir while the machine is at rest as well as when it is in mo ion.
Stalk Cutter. - John Carrey, De Soto, Mo. This is a machine desigued to evenly feed
the stalks to knives which are arranged to shred them, leaving them in better condition for food and permitu the dust to be more readily removed. The machine has anredding cylinder whose heads are connected by rods knife having the support of two rods, and the ends the knives being carried beyond the periphery of the cylinder. A suction fan draws all dirt from the shredde material as it passes to the exit chute at the bottom he machine.

## Miscellaneous.

Machine Gun.-Harry C. Webb, Taoma, Washington. This invention relates to rapid aring magazine guns, and is for a series of guns arfiring them. The gun has a central fixed barrel, and a series of barrels at each side adapted to swing in a hori zontal plane, there being a pair of magazines for each barrel, a rotary loading device in each magazine, and intermeshing gear wheels for rotating all of the loading devices, the breech doors being simaltaneously opened nd closed. The muzzes of the several guns may be readily swung inward, or toward the central gun, when it is desired to concentrate the fire, or swung outward to
cause the shots to diverge, and the several guns are taneously operated.
Money Cha nger. - George T. Farnell, Bayborough, N. C. This is a simple and easily operated
nechanism by which to deposit in a suitable receiver the different coins to aggregate the sum of change desired in any transaction. A casing is provided in which are holders for coins of each denomination, and by means of independently operated slides and detents, the apparatus is arranged to simultaneously discharge from sevained therein. In connection with the coin discharging devices, a drawer is arranged with compartments for notes and odd coins, the drawer being pressed outward by springs when its locking devires are released, and the entire apparatus is designed to greatly facilitate the
making of change, counting money and making it up into packages.
Vehicle Wheel Tire - Samuel S. Elder, Springfield, Ill. This invention provides a tubular cushioned tire which will not be much injured by be ing punctured, as its body is made up of a series of practically circular or endless springs, arranged at slight ntervals apart, and extending entirely around the rim of
the wheel against which they bear. All of the springe the wheel against which they bear. All of the springe
are bound together by an outer band which fits into de pressions of the springs, and the springs are held in their circular arrangement by a second inner band, the entire body being covered by any elastic or yielding maerial, as rubber, leather, or their equivalents.
Vfhicle Sand Band. - Charles $R$ Gibson, Woodsville, $\mathbf{N}$ H. This improvement com.
prises a hood having an extension adapted to engage the prises a hood having an extension adapted to engage the
axle, bands straddling the extension and holding the hood in position on the axle, there being springs between the extension and the bands. The sand band is readily astened in place on the axle to protect the inner end o
he hub, and may be conveniently removed as desired. Washboard - Frederic J. Merriam and James A. W. Sears, Escanaba, Mich. This board has an improved rabbing surface formed of a filled in the parts of the board together aganst longitudinal and transverse strains, the locking devices giving added strength to the washboard and forming a blind lock, being practically all concealed.
Note.-Copies of any of the above patents will be send name of the patentee, title of invention, and date of this paper.

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(7011) W. H. writes : 1. I built a dynamo described in one of your books (dynamos and motors), 22 lights, tdison style ; armature is wound 32 coils,
4 layers, 6 wires in each layer, No. 15 double-covered, 4 layers, 6 wires in each layer, No. 15 double-covered,
magnets wound with No. 23 doublecovered, 20 pounds on magnets wound with No. 23 double-covered, 20 pounds on
both; by running it two hours the commutator gets so both; by running it two hours the commutator gets so
overheated that it throws itself out of true. I have used carbon brushes, also tried copper brushes, and the heat ing is the same. How can I overcome it? A. Probably your brushes make insufficient contact with the commutator. Try wider brushes, and see that they are trued commutator for all their width.
2. Let me know what is used to make burrs (for feed mill) harder than other cast iron, that is, how to harden them while being cast ?
A. Cast in chills. The wearing side or end of the burrs should have a piece of iron, cast or wrought, placed in the mould, so that the fiuid metal will chill against the iron surface over the part that is required to be made
hard. See West's "Moulder's Text Book on Chilling hard. See West's "Mou
Castings," $\$ 2.50$ by mail.
(7012) J. C. B. says: Can you inform me of a polish that will remove fly specks from brass rubbed on cover them up? Ours are the usual bright kind. I presume they are brass and plated over, as they look as though they were gold plated. A. If you cannot
wash off the fly specks with soap and warm water on cloth, there is no way that an amateur can refinish lampwork with any satisfaction. To do this, the lamp must be taken apart and the brass work boiled in caustic soda to remove all oil and varnish; then rinse in hot water and dip in strong nitric acid for a few seconds only, when it will come out clean and bright ; then rinse clean in boiling water. Dry in sawdust, brush off, and lacquer
with thin shellac varnish. The metal must be warm and erfectly free from grease.
(7013) Z. M. A. asks (1) if it is possible to make a rectilinear photographic lens ont of two gether and separating them (the two lenses) a short distance, say one.twelfth of the focal length you want. A. Two lenses of same curves will, if set so that greatest
curves will be outaide, form a rectilinear picture on the ground glass, if swing back is properly used. Whether the negative will be good will depend on the chemical correction of the lenses. 2. About how many times the
focal length you want should the lenses be? A. The focal length you want should the lenses be? A. The
lenses must be the same focus to get perfect resulta, both the same focus, which will depend on length wanted in combined lenses. 3. I want to make a lens that will give me a flat view, nct drawn out so much as a single lens makes it. A. It 18 doubtful if a lens can be made that will give a perfectly fiat field with a sharp focus allover it, except by the use of a very small diaphragm. The as they give is at the expense of focus.
(7014) J. W. H. asks whether electricity generated by steam is more economical as a motive power
than steam power. A. It is only under exceptional circumstances that it is more economicul, as when the steam is generated and used in a large unit and electricity is used to subdivide the power into small units. This may be more economical, because small steam engines are no
as economical as large ones.

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